ENVIRONMENTAL ASSESSMENT ON CONDITIONS FOR LETHAL REMOVAL OF CALIFORNIA SEA LIONS AT THE BALLARD LOCKS TO PROTECT WINTER STEELHEAD

Supplement to the
Environmental Assessment on
Protecting Winter-Run Wild Steelhead
From Predation by California Sea Lions
in the Lake Washington Ship Canal,
Seattle, Washington (January 1995)

Prepared by

U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Marine Fisheries Service

March 1996

UNITED STATES DEPARTMENT OF COMMERCE
Office of the Under Secretary for
Oceans and Atmosphere
Washington, D.C. 20230

To All Interested Government Agencies and Public Groups:

Pursuant to the National Environmental Policy Act, an environmental review has been performed on the following action:

TITLE: Environmental Assessment on Conditions for Lethal Removal of California Sea Lions at the Ballard Locks to Protect Winter Steelhead.

SUMMARY: The National Marine Fisheries Service has prepared an Environmental Assessment that examines the environmental consequences of four alternatives for modifying the conditions of a Letter of Authorization issued to the State of Washington for the lethal removal of California sea lions at the Ballad Locks, Washington to protect the depressed Lake Washington winter steelhead population. The number of steelhead escaping to spawn has declined from about 2600 fish in the 1983 season to 184, 70 and 126 fish respectively in 1993, 1994 and 1995. The projected run size estimate for 1996 is 146 steelhead. Action to eliminate sea lion predation is necessary because the current number of returning adult steelhead is within the range considered to be near the threshold level below which the ability of the population to recover may be imperiled. A few individually identifiable sea lions have developed foraging behaviors which enable them to successfully prey on steelhead at the Ballard Locks in spite of non-lethal deterrent measures. Sea lion predation on the small return of adult spawners in 1996 and beyond, if not suppressed, is likely to have a significant negative impact on the status and recovery of this steelhead population.

The proposed action is to implement modified conditions that would allow the State of Washington to lethally remove "predatory" sea lions that are observed in the inner bay area at the Ballard Locks between January 1 and May 31 (the period of the winter steelhead run). A "predatory" sea lion is an individually identified sea lion that has been observed by biologists monitoring sea lion predation to have preyed on returning steelhead in the inner bay area of the Lake Washington Ship Canal (upstream of the railroad bridge) since January 1, 1994 (when the intense acoustic deterrence program began).

RESPONSIBLE PERSONS:

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The environmental review process led us to conclude that this action will not have a significant effect on the human environment. Therefore, an environmental impact statement will not be prepared. The finding of no significant impact and supporting environmental assessment is enclosed for your information.

Sincerely,

Donna Wieting
Director
Ecology and Environmental
Conservation Office

Enclosure

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TABLE OF CONTENTS

I. INTRODUCTION

Pursuant to Section 120(b) of the Marine Mammal Protection Act (MMPA), the State of Washington submitted an application to the National Marine Fisheries Service (NMFS) on June 30, 1994 requesting consideration of lethal removal of California sea lions at the Ballard Locks in Seattle, Washington. In response to the application, NMFS formed the Ballard Locks Pinniped-Fishery Interaction Task Force (Task Force). The Task Force met in late 1994, reviewed the available information and recommended approval of lethal removal with conditions. NMFS took the recommendations of the Task Force and public comments into consideration in approving lethal removal of California sea lions at the Ballard Locks. NMFS issued a three-year Letter of Authorization to Washington Department of Fish and Wildlife (WDFW) on January 4, 1995 that provided terms and conditions for lethal removal through June 30, 1997. NMFS prepared an Environmental Assessment (EA) in January 1995 that considered lethal removal as well as non-lethal alternatives and determined that the authorized lethal removal will not have a significant effect on the human environment in accordance with the Council on Environmental Quality's regulations implementing the National Environmental Policy Act (NMFS and WDFW 1995).

Section 120 of the MMPA requires that the Task Force "evaluate the effectiveness of the permitted intentional lethal taking or alternative actions implemented" and "if implementation was ineffective in eliminating the problem interaction, the Task Force shall recommend additional actions." The Letter of Authorization issued to WDFW incorporates this by allowing the terms and conditions of the Authorization to be modified by NMFS based on recommendations of the Task Force. Accordingly, the Task Force was reconvened in September 1995 to evaluate the effectiveness of the measures taken by the State in 1995 and prepared a report (Task Force 1995) with recommendations for modifications to the Letter of Authorization to eliminate sea lion predation on returning adult steelhead to the maximum extent possible.

This 1996 EA is a supplement to and augments the 1995 EA (NMFS and WDFW 1995) and considers four alternatives for modifying the conditions for lethal removal under the Letter of Authorization. This EA goes beyond the requirements of an Environmental Assessment for the benefit of the reader by presenting not just the environmental consequences of the proposed action and alternatives, but much of the background information and rationale on the need for protection of the winter steelhead population and the circumstances for removal of certain California sea lions from the Ballard Locks area. This EA also provides new information and results of actions taken to protect wild winter-run steelhead from predation by California sea lions in the Lake Washington Ship Canal in 1995.

Further background and details on the sea lion/steelhead conflict and efforts to address the conflict, as well as efforts to enhance the wild steelhead run, are described in detail in four Environmental Assessments prepared by NMFS and WDFW in 1989, 1992, 1994 and 1995, and in Scordino and Pfeifer (1993), Foley (1996), Fraker (1994), Gearin et al. (1986, 1988, 1989, 1995, 1996), Jeffries and Wilson (1995), Jeffries et al. (1989), Pfeifer (1987, 1988, 1989, 1991a, 1991b, 1994a, 1994b, 1994c, 1994d), Pfeifer et al. (1989), Norberg and Bain (1994), Norberg (1990), Tabor et al. (1994, 1995), NMFS (1992) and GAO (1993).

II. PURPOSE AND NEED

The purpose of the 1996 EA is to assess modifications to the Letter of Authorization necessary to better provide for recovery of the depressed Lake Washington basin winter steelhead. Extensive studies since 1985 have documented that predation by California sea lions is a principal factor affecting the spawning escapement of returning adult wild winter-run steelhead in the Lake Washington basin. A chronology of the efforts to resolve the predation problem is provided in Table 1. Because of the small size of the total wild run, which historically averaged about 2,500 fish each year, sea lion predation, by itself, has been documented to have prevented achievement of the wild steelhead spawning escapement goal of 1,600 fish in the Lake Washington basin in five of six years between 1985 and 1990, when the total wild run size was otherwise large enough to assure attainment of the escapement goal (Table 2). The winter steelhead population has declined significantly in the past ten years and recent spawning escapements have been less than 150 fish. Although other factors such as freshwater and ocean survival may be contributing to the declining status of the wild steelhead population, sea lion predation is a significant factor affecting the adult spawners that have survived and returned to the Lake Washington Ship Canal.

The wild steelhead population has declined dramatically in recent years to an all time low spawning escapement of 70 steelhead in 1993/94 (Table 2). The steelhead run is predicted to be only 146 fish this year and future runs are likely to be smaller (e.g., less than 100 steelhead returning in 1996/97). The 1995/96 steelhead run is comprised primarily of the progeny from the 1990/91 and 1991/92 brood years when escapements exceeded 200 fish, and therefore represents the "last best" opportunity to have sufficient numbers of spawners available upon which to base a potentially successful recovery program. There is concern that there is substantial risk for the recovery of the Lake Washington winter steelhead population based on the low returns of steelhead over the past two years. Because of the precarious status of the

TABLE 1. Chronology of Efforts to Address the Sea Lion/Steelhead Conflict

1980-84 California sea lion predation on steelhead at the Locks first noticed by the public in 1980. First use of firecrackers by State agents to harass sea lions out of area in 1981. Acoustic harassment device and firecrackers used by State agents in 1983/84 to deter sea lions. One to three sea lions observed almost every week in 1983/84.

1984/85 First documentation of the adverse effects of sea lion predation on steelhead escapement. One large sea lion ("Herschel") observed on a daily basis at the entrance to the fish ladder. Frequent public reports of large numbers of steelhead being eaten by sea lions. Intermittent use of firecrackers by State agents.

1985/86 Initiation of interagency monitoring and predation control program using underwater firecrackers. Number of sea lions foraging daily at the Locks increased to four to six. (Gearin et al. 1986)

1986/87 Harassment using firecrackers continues, but effectiveness in deterring sea lions declines drastically. Capture of sea lions in an entangling net was attempted unsuccessfully. Taste aversion conditioning using lithium chloride was attempted, however treated animals continued to exhibit predatory behavior delaying fish passage. Intensified harassment efforts implemented in late season involved long distance vessel chases, boat hazing, increased use of firecrackers and use of the AHD. Experimentation on use of killer whale vocalizations conducted. Number of sea lions increased to 8 to 10 at the Locks, 10 to 15 in Shilshole Bay and some animals were reported in Lake Washington. (Gearin et al. 1988)

1987/88 Barrier net installed in the spillway near fish ladder to prevent sea lion access to principal predation areas. Continuation of monitoring/harassment program. Additional harassment techniques were tested using firecrackers in combination with boat hazing. Number of sea lions increased to ten to twelve foraging daily at the Locks and 20 to 30 in Shilshole Bay. Sea lion predation was not reduced by the barrier net, rather the predation shifted further downstream. Several sea lions observed preying on steelhead in Lake Washington; one animal remained above the dam through the summer and preyed on sockeye salmon as they exited the fish ladder. (Pfeifer et al. 1989)

1988/89 Capture and relocation of 39 California sea lions to the outer coast of Washington (Long Beach peninsula). 29 of these returned to Puget Sound in an average of 15 days (ranged from 4 days to 45 days). 12 sea lions were recaptured more than once (9 twice, 1 three times and 2 four times) resulting in a total of 54 relocations. Ten to twelve sea lions foraged daily at the Locks through the season and the number in Shilshole Bay increased to 30-40. Sport and tribal fisheries on all steelhead in the Lake Washington system were closed to eliminate all takes of wild winter-run steelhead. Nonetheless, sea lion predation exceeds 65% of total run. (Pfeifer 1989)

1989/90 Capture and relocation of 6 sea lions back to their breeding area off southern California (Channel Islands). Attempts to capture more animals unsuccessful because animals did not utilize the haul-out trap. Three of the six animals returned to Puget Sound; one in 30 days and the other two in approximately 45 days from their release. A fourth animal returned as far as southern Washington (Columbia River). Tactile harassment program using rubber tipped arrows to deter animals was attempted. An interagency technical committee on structural changes to the Locks facility was convened, but did not arrive at any structural modifications; only made recommendations on fish passage studies and recommended modified water spill patterns over the dam. The recommended altered spill protocol was implemented. (Pfeifer 1991a)

1990/91, 1991/92 No predator control program as interagency emphasis shifted to fish enhancement efforts. Monitoring occurred only in the 1990/91 season. Amended spill protocol continued. Salinity of fishway attraction water and ambient salinity below the dam was monitored. Experimentation with illumination of the fishway to enhance nighttime fish passage was attempted and salinity data collection commenced. Test results on illumination were inconclusive and confounded by technical problems and low numbers of returning fish. (Pfeifer 1991b)

1992/93 Acoustic barrier for keeping sea lions away from fishway was tested intermittently. No consistent monitoring. Conclusions on the effectiveness of the acoustic devices was complicated by observations by AIRMAR (the manufacturer of the devices) that the devices may not have been operating at maximum efficiency because of algal and barnacle growth found on transducers. Spawning escapement drops to all-time low of 184 fish. (Pfeifer 1994c)

1993/94 Predation monitoring reinitiated. Phased non-lethal deterrence/removal program initiated with use of acoustic barrier, firecrackers, and capture and relocation. Three sea lions relocated late in season back to Channel Islands. Spawning escapement drops to all-time low of only 70 steelhead. (Pfeifer 1994d)

1994/95 MMPA amended to allow for consideration of lethal removal of sea lions at the Locks. Predation control under Section 120 of MMPA implemented allowing for lethal removal of sea lions under certain conditions. Predation monitoring underway in concert with use of acoustic barrier. Temporary captive holding attempted only with sea lion #17; other "predatory sea lions could not be captured during steelhead run. (Jeffries and Wilson 1995, Foley 1996)

TABLE 2. Lake Washington Wild Steelhead Escapement And Predation By California Sea Lions

Run Year	Run Size Estimate Preseason	Run Size Estimate Post-season	Steelhead Escapement	Escapement Goal	% Of Goal	Steelhead Killed by Sea Lions	% Of Post-season Estimated Run Consumed by Sea Lions
1982/83	—	—	2575	1600	161%	—	–
1983/84	—	2166	1250	1600	78%	—	–
1984/85	—	2527	474	1600	30%	?	?
1985/86	—	2261	1816	1600	114%	329	15%
1986/87	2965	2997	1172	1600	73%	1254	42%
1987/88	2635	2274	858	1600	54%	1178	52%
1988/89	1655	1973	686	1600	43%	1287	65%
1989/90	2093	1806	714	1600	45%	1065	59%
1990/91	2355	1520	621	1600	39%	899	59%
1991/92	1442	—	599	1600	37%	—	–
1992/93	1611	—	184	1600	12%	—	–
1993/94	1159	76	70	1600	4%	6	8%
1994/95	60 - 371	137	126	1600	8%	11	8%
1995/96	146			1600			

Data source: WDFW and NMFS Reports on monitoring sea lion predation at the Locks, and WDFW Winter-run Steelhead Inventory Tables. The "steelhead killed by sea lions" is an extrapolated estimate based on actual observations of kills.

population this year and in coming years, every returning steelhead may now be critical to the recovery process and no avoidable loss of steelhead should be allowed. Although adequate spawning habitat is available, steelhead escapement goals have not been met for the Lake Washington basin for the past 9 years. Lake Washington winter steelhead also are important as part of the larger Puget Sound steelhead population. The National Research Council has emphasized the importance of local breeding units within metapopulations as the fundamental unit of replacement for anadromous salmon. Incremental loss of components of a metapopulation is a concern because each loss diminishes the scope of genetic variation. The genetic variability within a population represents the reservoir upon which future evolutionary development depends. An adequate number of individuals for each local reproductive population is needed to ensure persistence of the many reproductive units that make up a fish stock. As described in Section IV.K., the number

of returning adult steelhead is now within the range considered to be near the threshold level below which the ability of the population to recover may be impaired. Therefore, sea lion predation on adult spawners returning in 1996 and beyond, will continue to have a significant negative impact on the status and recovery of this steelhead population.

As required by Section 120(c)(5), the Ballard Locks Pinniped-Fishery Interaction Task Force reconvened on September 6 - 8, 1995 to evaluate the effectiveness of measures taken by WDFW under the Letter of Authorization. Notice of the meeting, which was open to the public, was announced in local media as well as in the Federal Register on August 15, 1995 (60 FR 42146). Following its review and evaluation of information collected in 1995, the Task Force submitted a report on its findings and recommendations (Task Force 1995). Due to the low numbers of steelhead and continuing risk that sea lion predation poses for recovery of the run, the Task Force recommended modifications to the conditions on the lethal removal authorization to better preserve the steelhead run.

II.A. TASK FORCE RECOMMENDATIONS

The Task Force Report (Task Force 1995) was submitted to NMFS on November 8, 1995. The recommendations made by the Task Force, including modifications to the conditions for lethal removal, are summarized as follows.

1) The Letter of Authorization should be modified such that any individually identifiable sea lion observed killing steelhead (at the Ballard Locks) at any time before June 1, 1995 would be removed at the earliest opportunity after being observed in the area of Puget Sound between Everett and Shilshole Bay. Since these animals likely will be repeat offenders, they should be taken to permanent captivity or lethally removed, rather than released to come back again next year.

2) The Letter of Authorization should be modified such that individually identifiable sea lions that are first observed killing steelhead or salmon by trained observers in the Locks area after October 1, 1995 would be removed to captive holding for the remainder of the steelhead run, or be lethally removed if captive holding funding has not been made available. These are first-time offenders which may or may not become repeat offenders. The expectation is that if the sea lion is observed eating salmon in the area in the fall, it would eat steelhead later.

3) The Letter of Authorization should be modified such that any identifiable sea lion that has been observed engaging in foraging behavior, as interpreted by trained observers on

three or more days in the inner bay areas 1-4, may be removed, but only non-lethally if they have not been observed killing a steelhead or salmon. Also, if monies have not been allocated for non-lethal holding, then the animal could be relocated, but not lethally removed.

4) Active capture should remain an option available to agency personnel to deal with identifiable sea lions which have been observed killing steelhead and that have avoided the floating traps. Because of the increased risk to both animals and personnel, active capture attempts should only be directed toward sea lions which have been identified as candidates for lethal removal.

5) Fish count data should continue to be gathered and provided to the Task Force, as was done during the 1994/95 season. Effort should be made to improve the reliability of the data from the fish counter.

6) NMFS should install and operate acoustic deterrent devices for the entire time period that California sea lions are present at the Locks.

7) NMFS and WDFW should reconsider their decisions not to provide funding for the holding and care of captured sea lions. Private groups are encouraged to begin fund raising efforts immediately to have funding in place prior to capture activities. Funds for holding each sea lion must be immediately available prior to capture of each animal identified for possible lethal removal, or holding in captivity should be considered economically unfeasible and lethal removal is recommended.

8) Resource agencies should continue to pursue studies and investigate technologies to provide information on fish behavior downstream of the Locks, spillways, and fish ladder, to develop information on migration timing, pathways and milling patterns of returning steelhead. The current fish tracking study should be completed using coho salmon as a surrogate species for steelhead. The focus of the studies should be on the responses of migrating fish to different passage conditions. This information is integral to the future evaluation of fish refuge and physical barrier concepts.

9) WDFW and the treaty Indian tribes should develop and implement an aggressive steelhead recovery effort in cooperation with other interested parties.

10) The Interagency Fish Passage Work Group (convened by the U.S. Army Corps of Engineers, Seattle District) should consider means of protecting smolts from being drawn into the lock water system. In addition, the Work Group should

recommend means of improving smolt passage through the project. The work group should investigate ways to reduce bubbles created below the smolt slide.

It should be noted that only recommendations numbers 1-3 are for modifications to the Letter of Authorization (LOA). Those three recommendations on modifying the LOA are addressed as one of the alternatives (Alternative 2) in this EA. The other seven recommendations are primarily operational/logistical suggestions to NMFS and WDFW which do not necessitate any changes to the LOA. NMFS or WDFW have taken, or will take, action on each of these suggestions/recommendations as part of the plans for this season as described below.

Active Capture: The Task Force reaffirmed its previous recommendation that active capture should only be attempted for sea lions which have been determined to be eligible for lethal removal.

The Letter of Authorization to WDFW already contains this condition and NMFS is not proposing to modify it.

Acoustic Barrier: The Task Force recommended that NMFS continue to implement the acoustic barrier below the dam.

NMFS reinstalled the acoustic barrier in late October/early November for testing during the fall coho salmon run, and the acoustic system was reactivated on December 4. NMFS intends to continue operation of the acoustic barrier throughout the season through the smolt outmigration period. NMFS has obtained additional experimental acoustic equipment, with similar source levels from the manufacturer for testing this season. The experimental equipment can generate sounds at both 10 kHz and 17 kHz and will be installed to expand the area of intense ensonification to include the entrance to the large lock which is otherwise shadowed by existing structures. Observations are planned to evaluate the relative effectiveness of the two frequencies in deterring sea lions from entering the large lock area (zone 10).

Predation and Fish Passage Monitoring: The Task Force identified a number of data needs and recommended that data collection and monitoring be continued and that NMFS provide support to the State for this purpose.

NMFS has provided funding to the State to continue monitoring predation and fish passage at the Locks. Monitoring began on December 4, 1995, and is scheduled to continue through the smolt outmigration period. Observations will include sea lion identification, behavior of sea lions and harbor seals in the inner bay, steelhead escapement to the watershed, and smolt passage and

predation.

Fish Tracking Studies: The Task Force encouraged the resource agencies to continue studies and investigations to provide information on fish behavior downstream of the Locks and to complete fish tracking studies using surrogate species (coho salmon) to augment data collected on steelhead.

The U.S. Fish and Wildlife Service (USFWS), with support and assistance from NMFS, conducted fish tracking studies during the fall 1995 coho salmon run. The USFWS tagged and released 78 salmon, of which approximately one half returned and were tracked below the dam. The goal of the fish tracking studies is to provide the needed data on fish movements in the Ship Canal to allow a better assessment of factors which may affect fish passage or may be applicable in consideration of physical barrier or escape cover concepts. A report on those studies is in preparation.

Physical Barrier/Refuge: The Task Force encouraged resource agencies to continue investigations and studies which may provide information to assess the applicability of a physical barrier or refuge below the dam.

As indicated above, fish tracking studies using coho were conducted at the Locks last fall for the purpose of collecting fish behavior information recommended in 1990 by an interagency committee on feasibility of structural changes (including physical barrier) at the locks (Norberg 1990). Although WDFW and the Corps will continue to evaluate new designs and proposals for refuge and sea lion barriers, there are a number of factors that affect consideration of the efficacy of a physical barrier below the dam, including experiments on a physical barrier conducted in 1987/88 by Pfeifer et al. (1989) that indicated that predation was displaced to the face of the barrier and to other areas of the Ship Canal downstream from the barrier, rendering the barrier ineffective in reducing steelhead predation (NMFS and WDFW 1995). There is no new information to date which would overshadow the findings of the 1987/88 study, nor resolve the conceptual issues of a physical barrier. Regarding refuge, the fish tracking study was designed to provide data needed to assess this concept and hopefully address questions on whether wild steelhead might use refuge at this site to escape predation especially since steelhead do not appear to be utilizing existing cover at the Locks (piers, pilings etc.) to escape predation.

In the absence of a functional physical barrier, the acoustic devices deployed at the Locks do serve as an acoustic "barrier" to reduce the presence of sea lions in the fishway area. The acoustic devices currently in place at the Locks do appear to deter new sea lions from foraging

near the fish ladder and for the last two years, no steelhead predation has occurred in the spillway area when the devices were on.

Fish Counter: The Task Force believes that the data from the fish counter potentially provides a useful inseason index of the size of the steelhead run and recommends that the Corps Interagency Work Group be tasked with trying to improve the reliability of the data from the fish counter.

WDFW will continue monitoring the fish counter during the season and report on passage and predation as was done during the 1994/95 season. However, WDFW will only monitor the upstream counts and will not subtract the downstream counts due to concerns over the validity of downstream counter data.

Smolt Passage: The Task Force recommends that the Corps Interagency Fish Passage Work Group should maintain the resolution of difficulties encountered by outmigrating smolts as a high priority.

The Interagency Work Group has already identified priorities for further investigations to benefit smolt passage for 1996. Among the priority elements identified are further evaluations of the smolt slide in comparison with the fishway, hydroacoustic monitoring of smolts passing into the large lock water supply conduits and continued monitoring of lockages during the smolt outmigration. Deterrents to reduce smolt predation by gulls, including sprinklers below the lock chambers and bird wires over the tailrace will be implemented again this season.

Steelhead Recovery Planning: The Task Force believes that the State should implement an aggressive recovery effort for Lake Washington steelhead.

State efforts on conservation and recovery of the winter steelhead population are described in Section IV.L. of this EA. WDFW is preparing a Lake Washington steelhead enhancement and management plan that is expected to be available to the Task Force in March 1996.

Additional details on the Task Force evaluation and recommendations as well as the minority views are in the Task Force report (Task Force 1995). NMFS has taken the Task Force Report, including the recommendations and rationale, and the results of the 1994/95 season into consideration in deciding whether to modify the Letter of Authorization issued to WDFW on January 4, 1995.

III. ALTERNATIVES INCLUDING THE PROPOSED ACTION

NMFS considered 4 alternatives for responding to the Task Force recommendations for modifications to the Letter of Authorization; 1) Take No Action to Modify the Conditions for Lethal Removal (Status Quo Alternative); 2) Implement Modified Conditions for Lethal Removal as Recommended by the Task Force; 3) Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Steelhead at Locks (Proposed Action); and 4) Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Salmonids at Locks. Alternatives, other than those pertaining to the conditions on lethal removal, are described and assessed in the January 1995 Environmental Assessment (NMFS and WDFW 1995) and are not repeated herein.

III.A. Alternative 1 - Take No Action to Modify the Conditions for Lethal Removal (Status Quo Alternative)

This alternative maintains the "status quo" and no action would be taken to modify the existing conditions for lethal removal authority granted to WDFW on January 4, 1995. Under the terms and conditions of the existing authority, predatory sea lions (i.e., sea lions which have been observed taking steelhead at the Ballard Locks during past runs) may be lethally removed if 1) non-lethal deterrence is attempted; 2) the sea lion predation rate exceeds 10 percent of the available steelhead in any consecutive 7-day period after January 1; and 3) adequate holding facilities are unavailable or temporary holding is infeasible or impractical. The 1995 Environmental Assessment (NMFS and WDFW 1995) considers this alternative for lethal removal with non-lethal alternatives.

The "status quo" is not preferred for several reasons. The Task Force recommended modifying the status quo because the current lethal removal "trigger" is based on the rate of predation and therefore requires some, otherwise potentially avoidable, steelhead mortality. The Task Force also recommended changing the status quo to ensure that the predatory sea lions, because of their known behavior to forage and kill steelhead in the Locks area in spite of deterrence efforts, should be captured and removed permanently either to a permanent holding facility or lethally removed, rather than released only to come back again. Given the extremely small size of the run, the Task Force recommended that all avoidable mortality from predation should be eliminated. As described in Section IV.K., the Lake Washington steelhead population is now within the range considered to be near the threshold level below which the ability of the population to recover may be impaired. Predatory sea lions which have developed successful foraging strategies for steelhead at the Locks, in spite of intense deterrence efforts, are having a significant negative impact on the status and recovery of the

winter steelhead population. Allowing predatory sea lions to forage successfully at the Locks before taking action only exacerbates the problem, especially since the predatory sea lions will likely kill more steelhead between the time when the lethal removal "trigger" is achieved and when the sea lion is removed (e.g., see Section IV.G. regarding sea lion #225 which was not captured until over three months after it killed three steelhead). Lastly, as described in Section V.A., temporary captive holding of sea lions is not a prudent or practical measure for eliminating the problem interaction at the Locks.

III.B. Alternative 2 - Implement Modified Conditions for Lethal Removal as Recommended by the Task Force

This alternative is to implement the recommendations of the Task Force to modify the conditions for lethal removal under the existing authority. The Task Force recommended changes to the existing Letter of Authorization (LOA) because of concern that there is substantial uncertainty regarding the recovery of the Lake Washington winter steelhead based on the low returns of steelhead over the past two years. Because of the precarious status of the population, every returning steelhead may now be critical to the recovery process and no avoidable loss of steelhead from sea lion predation should be permitted. Under this alternative, the LOA conditions would be modified to require that predatory sea lions (i.e., sea lions which have been observed taking steelhead at the Ballard Locks during past runs) be captured and placed in permanent captivity or lethally removed as soon as they return to Puget Sound in the area from Everett, Washington to Shilshole Bay. Newly identified predatory sea lions, which have been observed taking salmon or steelhead at the Locks after October 1, 1995, would be captured and placed in temporary captivity for the remainder of the steelhead run or lethally removed if funding for captive holding is unavailable. Lastly, the Task Force recommended the non-lethal removal of sea lions that forage in the ensonified zone for three or more days; such animals should be placed in captivity or relocated, but not lethally removed.

The Task Force recommended that the capture and removal of predatory sea lions should commence immediately if these identifiable predatory sea lions, who have predated steelhead in the past, return to Puget Sound in the area from Everett to Shilshole (the area that the predatory sea lions are known to frequent when they migrate into Puget Sound each year). The Task Force also recommends that the predatory sea lions, because of their known behavior to forage and kill steelhead in the Locks area in spite of deterrence efforts, should be captured and removed permanently either to a permanent holding facility or lethally removed, rather than released only to come back again. The Task Force recommended non-lethal removal of sea lions that forage for three or more days in the ensonified zone because sea

lion foraging in front of the fishway impedes fish passage and allowing this behavior to continue would likely result in a steelhead mortality when steelhead are available.

As described in Section IV.H., NMFS has surveyed all marine mammal holding facilities and was unable to find any facility that was interested in obtaining one of these sea lions for permanent holding. The predatory sea lions therefore would be lethally removed under this alternative. This alternative could result in the capture and removal of sea lions prior to their occurrence in the area of primary concern at the Ballard Locks during the steelhead run. In addition, this alternative continues the requirement for temporary captive holding for sea lions that are observed killing steelhead or salmon at the Locks after October 1, 1995. However, as described in Section V.A., temporary captive holding of sea lions is not a prudent or practical measure for eliminating the problem interaction at the Locks.

Other Task Force Recommendations

The Task Force also had a number of additional recommendations on active capture, non-lethal deterrence, fish passage monitoring, data needs, funding, refuge/barrier and fish tracking studies, recovery planning and smolt passage issues. These recommendations are primarily operational/logistical suggestions to NMFS and WDFW which do not necessitate any changes to the Letter of Authorization. NMFS or WDFW have taken, or will take, action on each of these suggestions/recommendations as part of the plans for this season as described in Section II.A. above.

III.C. Alternative 3 - Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Steelhead at Locks (Proposed Action)

The proposed action is similar to Alternative 2 and is based on the Task Force recommendations. However, the modifications to the conditions for lethal removal are slightly different than that recommended by the Task Force. The proposed action is to implement modified conditions that would allow the State of Washington to lethally remove "predatory" sea lions. The definition of a "predatory" sea lion is an individually identifiable California sea lion that: 1) has been observed by biologists monitoring sea lion predation to have preyed on returning steelhead in the inner bay area of the Lake Washington Ship Canal (upstream of the railroad bridge); 2) has penetrated the acoustic barrier and has been observed foraging in the ensonified zone during the steelhead run since January 1, 1994 (when the acoustic deterrence program began); and 3) is observed engaging in foraging behavior in the inner bay area (upstream of the railroad bridge) during the steelhead season between January 1 and May 31 by biologists monitoring sea lion predation at the

Locks. The proposed action is the same as Alternative 2 in eliminating the lethal removal "trigger" based on predation and fish counter data. The proposed action deviates from the Task Force recommendations in that the "predatory" sea lions must be observed foraging in the inner bay area between January 1 and May 31 (the period of the winter run) in order to be candidates for lethal removal during the same period. Also, the proposed action deviates from the Task Force recommendations in that it removes the requirements for captive holding because the captive holding recommendations by the Task Force are not practical (i.e., as described in Section V.B., there are no permanent holding facilities available) and, as described in Section V.A., temporary captive holding is not a prudent alternative for resolving the predation problem at the Locks.

The proposed action provides a clear definition of what constitutes a "predatory" sea lion that may be lethally removed. "Predatory" sea lions would be those California sea lions that: 1) have been observed to effectively forage on free swimming returning steelhead in the inner bay area (zones 1-10) of the Lake Washington Ship Canal, 2) have not been deterred from this behavior by the presence of an acoustic barrier or other non-lethal deterrence measures, and 3) have returned to forage in the inner bay during the winter steelhead season from January 1 to May 31. Individually identifiable sea lions which meet these conditions could be lethally removed only during the period of the steelhead run season (January 1 to May 31) when they have a significant negative impact on the status or recovery of the steelhead population.

The proposed action would allow the State to respond quickly to lethally remove known "predatory" sea lions, which by their presence in the area and demonstrated foraging behavior at the Locks, pose a significant threat to returning winter steelhead and the recovery of the run. This alternative would reduce avoidable steelhead impacts due to sea lions to the maximum extent practicable, while protecting sea lions that do not have significant negative impacts on the status or recovery of the steelhead population.

III.D. Alternative 4 - Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Salmonids at Locks

This alternative is the same as Alternative 3 except that the definition of "predatory" sea lions would include observed predation on returning steelhead or salmon. Several sea lions that have been observed foraging at the Locks in the ensonified zone since implementation of the acoustic deterrence program in 1994 have yet to be observed to actually kill a steelhead. But several sea lions, which are known to forage at the Locks during the steelhead run, have been 1) observed killing unidentified

salmonids during the steelhead run, 2) observed killing chum salmon at the Locks just prior to the steelhead run, 3) observed killing sockeye just after the steelhead run, and 4) observed killing coho salmon at the Locks during the fall coho run. It is likely that the sea lions that have killed any salmonid at the Locks during the deterrence efforts will be a threat to returning steelhead if those sea lions are present during the steelhead run. This alternative would be the same as Alternative 3 except that it would allow for removal of "predatory" sea lions (that have killed returning salmonids at the Locks) as soon as they return to the Locks, rather than waiting to confirm the kill of a steelhead.

IV. AFFECTED ENVIRONMENT

The affected environment is described in the 1995 Environmental Assessment (NMFS and WDFW 1995).

The 1995 EA also describes and assesses all of the known potential non-lethal alternatives for addressing the predation problem at the Ballard Locks. This EA contains additional information on some of the non-lethal alternatives. New information collected in 1995 on the acoustic barrier and sea lion movements (as it pertains to the effectiveness of translocation of sea lions) is described in Sections IV.E. and IV.I. Recent improvements that have been made to enhance fish passage at the Locks are described in Section IV.B..

New information on sea lion abundance in Puget Sound is presented in this EA as well as data on individually identifiable sea lions and their movements and behavior especially as it relates to predation on steelhead. Also, the results of new studies in 1995 on sea lion predation on smolts, and coho and sockeye salmon at the Locks, and the implications of this foraging behavior on steelhead are also discussed herein.

IV.A. Geographic Location

Figure 1 shows the geographic location of the Ballard Locks, the lake Washington Ship Canal, Shilshole Bay and Puget Sound. A complete description of the geographic location is provided in NMFS and WDFW (1995).

IV.B. Modifications to the Locks Facility and Fishway Operations in 1995

In July 1994, the U.S. Army Corps of Engineers (Corps) established an Interagency Working Group (Work Group) to discuss salmonid passage issues. The Work Group consists of agency professionals from the Corps, WDFW, NMFS, USFWS and the

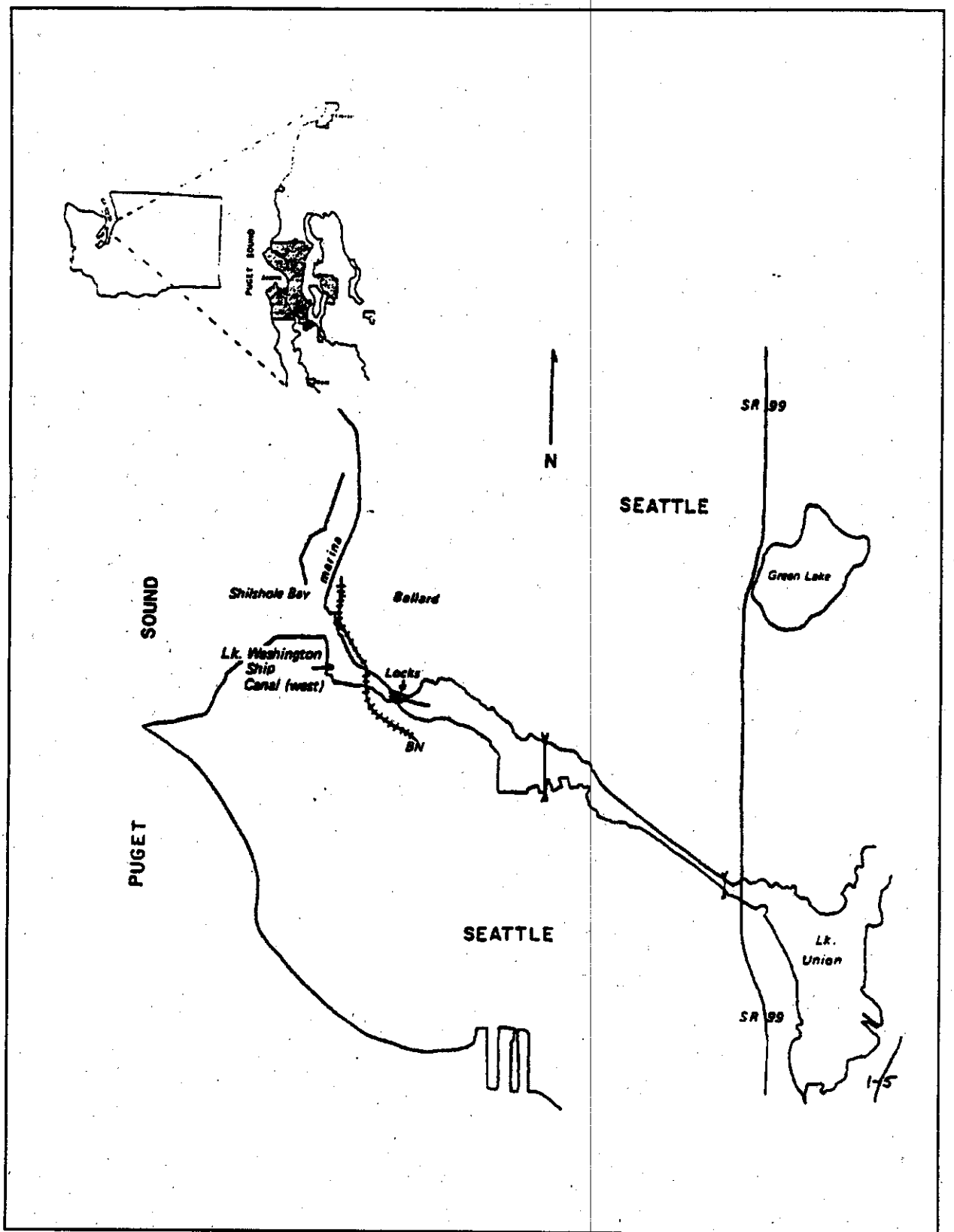

Figure 1. Location of the Lake Washington Ship Canal, Ballard Locks, Shilshole Bay area.

Muckleshoot and Suquamish Indian Tribes. In addition, King County Surface Water Management and the Seattle Water Department have been invited as observers. Numerous meetings of the Work Group were convened in 1994/95 to discuss issues and concerns related to both successful smolt and adult salmonid passage through the Locks facility.

Concurrent with the Work Group meetings, the Task Force was convened to address the sea lion steelhead conflict. One outcome of the Task Force discussions was the recommendation that the Work Group focus its attention on six issues which the Task Force believed to be potential contributing factors in the sea lion/steelhead interaction. The Work Group reviewed these issues and recommended appropriate actions to address them. The six issues were:

1. Entrance Pool Head (EPH) at the Fishway. Ensure velocities exiting the fishway meet the best available fish attraction criteria, across all tide levels.

2. Spill Protocol. Review operations at the spillway dam and if indicated, modify spillage at the two gates nearest the fishway entrance to guide fish toward the entrance.

3. Fallback of Steelhead From the Fishway. Using the information from the 1993/94 and 94/95 sonic fish tracking studies, assess whether steelhead entering the fishway are subsequently returning to the tailrace (falling back) rather than passing through the fishway.

4. Water Spray at the Fishway Entrance. Create a surface disturbance and evaluate the ability of water spray to attract and hold adult steelhead near the entrance to the fishway.

5. Lighting at the Fishway. Evaluate shading the area inside the fishway entrance, during daylight hours, and illuminating at least the first two weirs of the fishway at night.

6. Salinity in Attraction Flow. Decrease salinity of the attraction flow at the fishway entrance.

Following review and discussion of these issues, the Work Group made a number of recommendations to the Corps. The Corps submitted a letter to NMFS that responded to each of the issues on December 28, 1994, and updated the information on August 31, 1995. Many of the Work Group recommendations were implemented by the Corps in 1995 as described below.

The Work Group recommended that EPH be maintained at 1.0 to 1.5 feet of head (Issue 1) for optimum fish attraction with the

current design. The Work Group requested that records be kept on EPH and tide elevations and on gate openings. The Work Group also recommended that the Corps provide the ability to close the fixed width side entrance slot and install a movable (telescoping) entrance weir in place of the existing downstream entrance leaf gates. The Corps implemented manual control efforts and installed a new fishway control module as a temporary measure while evaluating the effects of this recommendation on fishway operations (the recommended changes increased attraction flows over original design specifications). According to records kept pursuant to the recommendation, with the new control module in place, the EPH was maintained within the recommended range except during periods of extreme high tide and salt water drain operation. The Corps further amended operation of the salt water drain so that the effects of low EPH would be minimized by opening the salt water drain at night when steelhead movement is minimal. The ability to close the side entrance slot is available if requested by resource agencies (no request for closure was made in 1995). As a follow up to the evaluation of alternative control measures for regulating fishway operation a new control system design has now been completed and a contractor is working on installation. The new control system replaces the old modular control and offers increased automated flexibility for fishway operation, and will accommodate future modifications to the fishway entrance weir when installation is possible.

The Work Group reviewed the spill protocol (Issue 2) and recommended that a six inch opening be maintained on tainter gate number 5 in combination with closure of the saltwater drain during the steelhead season. A more flexible lake level rule curve was also recommended to allow for water storage in support of the amended spill pattern. The saltwater drain was to be reopened if the fishway salinity exceeded eight parts per thousand. The Work Group also recommended that a surface spill structure (smolt slide) be constructed and evaluated to improve smolt passage. Birdlines were recommended to protect smolts in the tailrace from predation by gulls. For further evaluation of spill and saltwater drain operation, the Work Group also suggested additional sensors to monitor water quality in the fishway and upper ship canal for analysis with fish tracking results and to guide water management decisions.

The Corps implemented the new spill and saltwater drain protocols. During the spring of 1995, the Corps implemented an amended water management rule curve for the regulation of flows through the Locks facility. The amended curve provided increased flexibility by allowing extra water to be stored in the lake and spilled more slowly over a longer period following storm events. The slower discharge of water resulted in more consistent attraction flows from tainter gate number 5 (near the south end of the dam) to improve steelhead attraction to the fishway. The amended rule curve provided more reliable and consistent attraction flows during the steelhead run without impacting water

availability during the summer months.

Also in 1995, an experimental smolt slide was constructed and fitted to tainter gate number five. The smolt slide consisted of a flume for providing surface spill flows of 85 cfs during the smolt outmigration period. The smolt slide is under evaluation as part of a larger and continuing effort to provide safer routes of egress for smolts leaving the Lake Washington system and help restore declining salmon and steelhead runs in the drainage. Early results from the surface spill test were encouraging and further testing will continue in 1996. The Corps also intends to continue using and evaluating other systems to reduce smolt predation by birds such as sprinkler systems below the Lock chambers and bird wires over roosting areas on the facility and over the tailrace.

In their evaluation of agency activities conducted during the 1995/96 run period, the Task Force noted that sea lions had been observed preying on smolt below the smolt slide and remarked that the smolt slide introduces a considerable amount of entrained air to the tailrace area. Entrained air is known to reduce the effectiveness of the acoustic deterrence devices (Norberg and Bain 1994). Reduced acoustic deterrence effectiveness may then contribute to smolt predation by sea lions. In order to access the smolt slide discharge area, sea lions must penetrate the acoustic barrier. However, after passing through the area where the sound intensity is greatest (near the safety cable) sea lions can forage in the bubble cloud below the smolt slide.

The 1995 smolt slide test design includes a maximum dewatering feature which is needed for the evaluation of the surface spill concept. Dewatering produces cascading water and bubbles below the slide. Modifications planned for 1996 include a moveable weir to manage surface spill. Surface spill in 1995 was 85 cfs, but the new weir permits flow regulation from 35 to 85 cfs. Reduced out flow could reduce entrained air. If further testing indicates that permanent incorporation of surface spill slides for smolt passage is warranted, design engineers may take the recommendation to reduce entrained air into consideration during the design phase.

The fishway was fitted with an additional sensor and improved controls for 1995. Three sensors were installed upstream from the dam to monitor salinity in the upper ship canal. The new sensors allow close monitoring of fishway and lake salinity which results in reduced use of the saltwater drain for controlling water quality, while maintaining low salinities in the fishway. Low fishway salinity was indicated as a desirable factor for improving fish passage by past analysis (Infometrix 1994). Use of the saltwater drain results in attraction flows away from the fishway which could delay adult passage. In addition, the saltwater drain may provide an undesirable route for outmigrants. The improved controls resulted in better attraction flows from

the fishway by maintaining the entrance pool head differentials more accurately for the majority of tide heights.

The Work Group believed that fallback (Issue 3) was low priority at the time of its review. Preliminary information from the fish tracking study provided no indication that fallback is a concern at this site. The Work Group noted that some fallback may be a natural result of fish from adjacent systems "testing" the entrance to Lake Washington before moving on. The Work Group did not recommend any further investigation on this as it was not believed to be an issue.

The Work Group believed that installing water spray at the fishway entrance (Issue 4) was low priority for the 1995/96 season. While surface water spray may attract fish to the fishway entrance, there is no guarantee that they will enter. Attraction without entry would increase the risk of predation by sea lions in front of the ladder. Future evaluation of water spray as an additional attraction to the fishway was postponed until an effective predator barrier might be available.

The Work Group recommended that gradual transition lighting for reducing contrast from high intensity to low intensity areas in the fishway (Issue 5) should be evaluated. The Corps has researched the feasibility of day and night testing of thallium iodide lighting for this purpose. Purchase of lighting is in progress with potential installation anticipated by early April.

The Work Group recommended that fishway salinity (Issue 6) should be kept low (below 9-10 ppt) to reduce the possibility that high salinity may inhibit fish passage. As described above, the Corps is operating the fishway with an interim threshold of eight parts per thousand in response to the Work Group recommendation.

The Work Group also recommended that evaluation of physical barrier or refuge concepts should continue. Evaluation of these concepts is complex because they must be designed such that they will not compromise the safe operation or structural integrity of the locks, dam or ship canal project. Any barrier must be located as distant from the fishway as possible to increase the refuge area. The barrier must be designed to withstand high flows and debris without jeopardizing the safety of the project or downstream structures. The barrier must not result in just a shifting of the predation problem further downstream or at the face of the barrier. The barrier must effectively pass fish during low or no flow periods. Given all of these requirements, many of which may not be feasible with a physical barrier, the Work Group recommended that until an acceptable design is developed, the acoustic devices should continue to be used since they function as an "acoustic barrier" that does appear to exclude sea lions from the area. The Work Group recognized though that the few sea lions that are not deterred by the acoustic barrier would be candidates for lethal removal. Through

1995, the Corps continued to support WDFW, which has taken the lead in assessing barrier concepts, in evaluating physical barrier proposals.

IV.C. Fish Counter

During their evaluation of activities taken under the Letter of Authorization, the Task Force recognized that real time estimates of steelhead passage into Lake Washington were affected by the reliability of the automatic fish counter. This in turn influenced the determination on when or if predation rates were above levels deemed to be excessive (i.e., more than 10% of available fish within a seven day period) thereby triggering the lethal removal authority, or at or below levels thought to be acceptable (10% or less of available fish during 14 consecutive days of fish passage) thereby suspending the lethal removal option.

Under ideal conditions, returning adult steelhead passing through the fishway would be tallied as they pass through the counter tunnel on their way upstream to the lake. Fish which fall back to a weir downstream of the tunnel would be tallied as "down counts" and would be subtracted from the total number of steelhead passing into the lake for a given time frame. An index of steelhead passage thereby could be obtained on a daily basis and compared to observed predation mortalities in order to assess whether the lethal removal "trigger" had been achieved. However, the use of the fish counter to determine availability of steelhead for purposes of the "trigger" has been shown to be problematic.

Three elements influence the reliability of fish counter data; a) the presence of non-steelhead salmonids passing through the system in the early season (i.e., the fish counter tallies "targets" of a preset size and cannot distinguish non-steelhead targets); b) the proportion of fish that jump over the fishway weirs rather than go through the counter tunnel; and c) the reliability of the fish counting equipment itself. In November and December, salmonids other than steelhead use the fishway to enter and sometimes exit Lake Washington. Chum, coho, and sockeye salmon, cutthroat trout, as well as non-anadromous species, have all been observed in the fishway viewing chamber (where the counter is located) during the November to June timeframe when steelhead may be present. The counter tunnel does not surround the entire water column in the weir, it is in the 18 inch square hole at the bottom of the weir, and fish can jump over the top of the weir. The tunnel has practical size limitations owing to the designed size of the orifice through the weir at the downstream end of the viewing chamber. Some fish will jump over the weirs in the fishway and therefore are not counted. Blocking the area over the weir was attempted and is not desirable because fish were observed attempting to pass

anyway and were injuring themselves. Also blocking the top of the weir provides a catch point for debris which would otherwise pass through the system.

The reliability of the counter can be affected by outside (or environmental) influences as well as functional or design limitations. Bubbles, debris or the presence of non-steelhead can all effect the accuracy of fish counter tallies. In addition, interpretation of tallies may be hampered by the fact that the counter tallies "targets" in both directions (i.e., upstream and downstream passage). This presents a problem because upward migrants may move both upstream and downstream between weirs when passing through the fishway and cannot be distinguished from outmigrants or debris targets. In addition, the tallies may be "thrown off" by unit malfunctions which cannot be diagnosed by superficial examination of the equipment.

Efforts to verify steelhead passage and counter tallies are severely hampered, by the low numbers of steelhead. In an attempt to determine the reliability of the fish counter during a period when numbers of fish are present, observations were conducted by NMFS and WDFW during the 1995 fall coho salmon run. During timed counts, conducted by NMFS in October, the counter was found to be quite unreliable. During two timed visual observations, the number of fish passing over the weir (21) was roughly equivalent to the number passing through the automatic counter tunnel (24). However, only six of the fish that passed through the tunnel were tallied by the counter and therefore in addition to under-representing the total number of fish present, the automated count was also inaccurate.

Timed counts conducted by WDFW in November 1995 showed better results for tallies of fish passing through the tunnel, but verified the problems of "down count" interpretation. During one count, five fish went through the counter tunnel and were tallied, while four fish jumped over the weir and were not. One small bass passed through the tunnel heading downstream and was not tallied. Later during a second count, nine adult coho salmon and two jacks passed through the tunnel and four adults and one jack jumped over the weir. The counter tallied nine fish up and three down. The down counts were anomalous because no fish passed downstream during this observation period.

WDFW will continue to monitor the fish counter in 1996, however, the past practice of subtracting down counts will not be done because of the difficulty in interpreting this information. The tallies from the fish counter will be reported periodically as occurred last season.

IV.D. California Sea Lion Abundance and Distribution

California sea lions occur on a seasonal basis in Washington

waters, although a few animals may remain year-round. California sea lions migrate into Washington waters each fall from southern California and Mexico where they breed. California sea lions are found in Washington waters primarily from September to June. Except for one or two females that have been reported, all of the California sea lions that migrate into Washington are males of ages five to fifteen.

As shown in Figure 1, a record number of California sea lions were counted in Puget Sound in 1995. On April 21, 1995, a record 1,113 were reported by Gearin et al. (1996) at Everett. The Everett area is the center of sea lion abundance in Puget Sound and is used as an index to sea lion abundance. The April 21, 1995 survey yielded the highest count of California sea lions ever recorded in Puget Sound (1,234 sea lions).

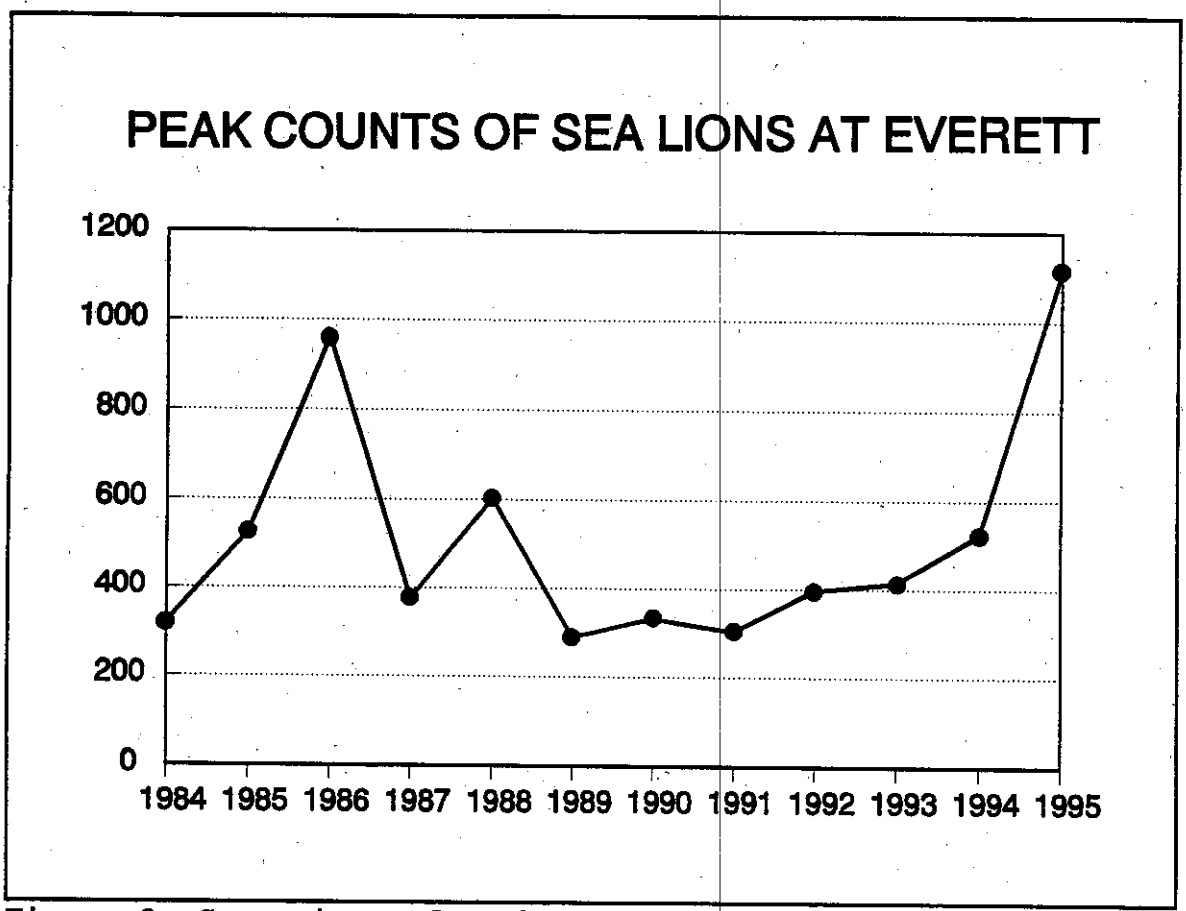

Figure 2. Comparison of peak counts of California sea lions at Everett, Washington.

California sea lions are seasonally abundant in Puget Sound. The seasonal abundance trend over the past 8 years is shown in Figure 2. Sea lion abundance in Puget Sound (based on the Everett area

index counts) begins increasing in the fall as the sea lions migrate back into northern waters with peak fall/winter counts in November/December and then peak overall numbers in March/April. California sea lion abundance decreases dramatically when the sea lions begin migrating south in May/June. During the 1994/95 migration, a record high count of 614 sea lions was recorded at Everett during a survey conducted on December 14, 1994. Following that date, the number of sea lions declined in January and February 1995, both at Everett and throughout Puget Sound. The decreases in Washington waters were accompanied by an increase in counts in British Columbia. Sightings in Canada in February 1995 of sea lions previously branded at Shilshole indicated that many of the sea lions from Puget Sound had moved to the waters near Nanaimo, Vancouver Island, B.C. (Gearin et al. 1996). From February through April 1995, the number of sea lions in Puget Sound again increased until the record high count on April 21, 1995. The peak count in late April constitutes a change from what generally occurred in previous years, when peak counts occurred during surveys conducted in late March and early April. Counts of sea lions at Everett dropped to zero on June 16, 1995 (Gearin et al. 1996).

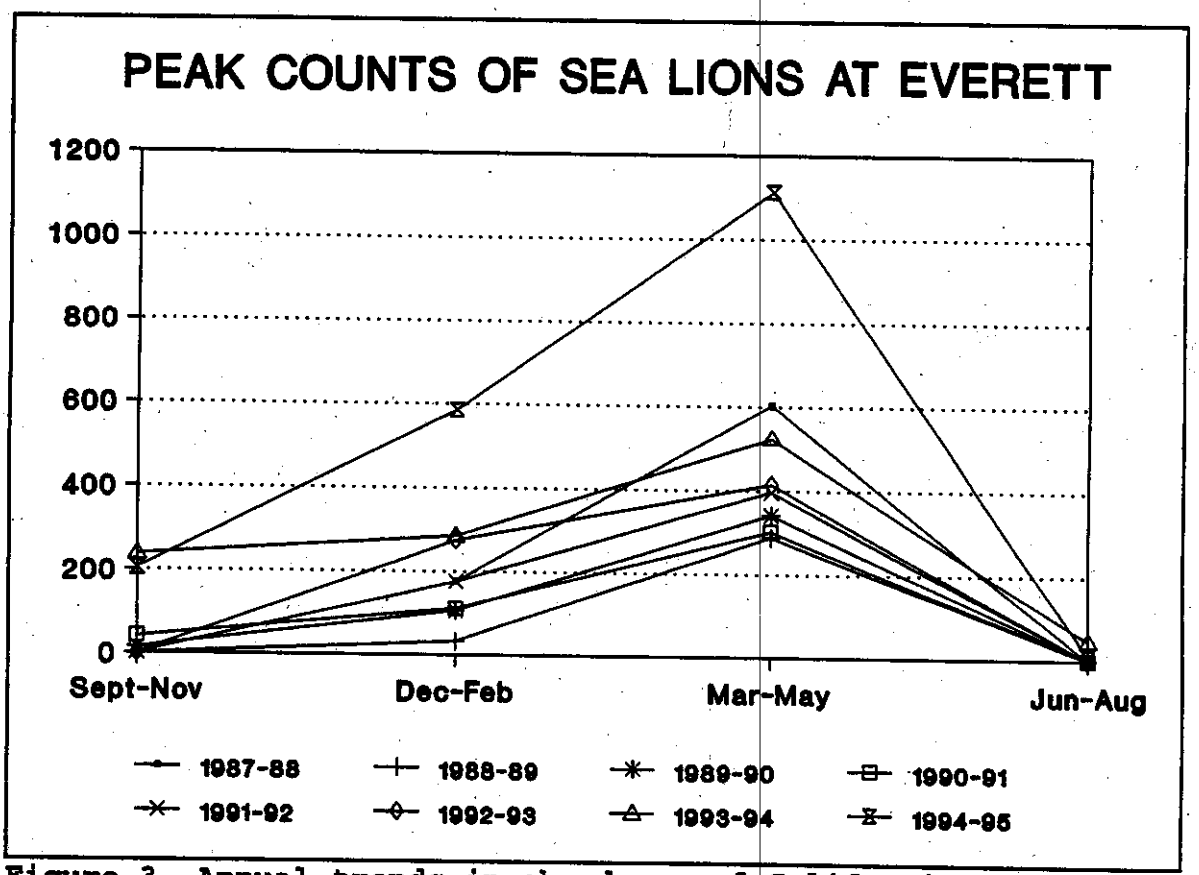

Figure 3. Annual trends in abundance of California sea lions in Puget Sound (based on counts at Everett, WA).

In the 1995/96 migration, California sea lion abundance began increasing in Puget Sound in August 1995 when 10 sea lions were counted at Everett. Peak counts at Everett increased to over 200 in September, over 500 in October, and reached 905 in November before declining to just under 600 in December 1995. Although the 1994 and 1995 counts in December were similar (614 and 593 respectively), counts in November 1995 were notably higher than the previous year (905 as compared to 551 in 1994). As shown in Figure 2, the trend toward greater numbers of sea lion arriving earlier in Puget Sound continued in 1995.

Similar overall trends in sea lion counts (to those at Everett) were noted by Gearin et al. (1996) at Shilshole in 1995 (Figure 3). Numbers at Shilshole began increasing in the fall, starting with 4 sea lions on September 11, growing to 40 animals on November 10, 1995. The number of sea lions then declined for a short period between mid-November and mid-December, with counts of less than 10 animals predominating (Gearin et al. 1996). The numbers swelled to over 40 sea lions in late December concurrent with an increase in the local abundance of market squid (Loligo opalescens) in the area. Numbers then declined again to just a few animals until late March. The number of sea lions increased in March and April and the maximum count (93) was observed during a survey conducted on May 3. Counts of sea lions at Shilshole dropped to zero on June 27, 1995 (Gearin et al. 1996).

IV.E. Movements/Resights of Marked California Sea Lions

During the 1994/95 season, 210 California sea lions were captured on the trap in Shilshole Bay (on an opportunistic basis determined by sea lion availability, weather, etc.) and permanently marked (branded) thereby increasing the total number of sea lions marked at Shilshole Bay to 255 sea lions (marked from February 1989 through June 1995). New information on the resights, movements and migration of California sea lions from this increased number of marked sea lions in Puget Sound is presented in Gearin et al. (1995 and 1996). Appendix A provides a record of resight information on the sea lions that have been marked since 1989. As of January 1996, nine of the marked sea lions are known to have died (#'s 2, 4, 9, 15, 24, 48, 110, 151 and 256). Sea lion surveys in Puget Sound and capture and marking operations in Shilshole Bay, which recommenced in November 1995, will provide additional information this season.

Of the 210 sea lions captured at Shilshole Bay during 1994/95, 94 have been observed back in Puget Sound as of November 26, 1995, following the summer migration. Sea lions began arriving back in Puget Sound in August. Many of the sea lions captured and marked at Shilshole are resighted in other areas of Puget Sound, especially at Everett (see Appendix A). Of the 210 sea lions

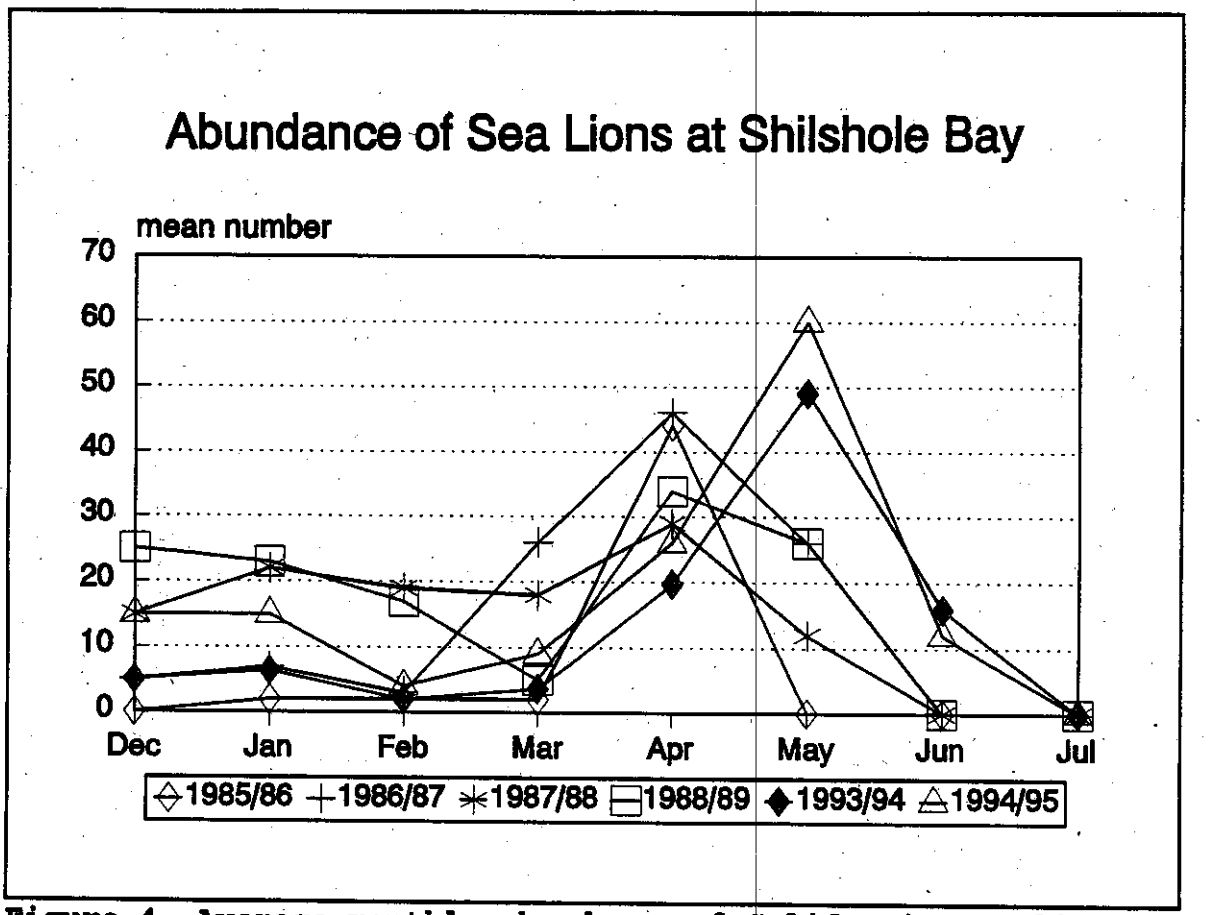

Figure 4. Average monthly abundance of California sea lions at Shilshole Bay, Washington.

marked in 1994/95, 168 were resighted in Puget Sound more than 24 hours following release. Resights in 1994/95 of sea lions marked in earlier years were as follows: four of the 39 sea lions marked in 1989 (#'s 14, 17, 34 and 37); one of the three marked in 1990 (#41); and, two of the three marked in early 1994 (#'s 45 and 46).

As presented in Appendix A, 100 sea lions captured at Shilshole Bay from 1989-95 were observed or recorded by radio telemetry in California from June-August, 1995. Of this total, 80 were observed at San Miguel Island and 14 at San Nicolas Island. Four of the five sea lions that have been observed to date preying on salmonids in the ensonified zone at the Locks were documented on Channel Islands in summer 1995 and have returned to the Locks in fall/winter 1995.

Resights of the total sample of 248 marked sea lions (total marked less mortalities) indicate that many of the sea lions marked at Shilshole Bay appear to have been captured as they were passing through the area, and do not appear to remain in the Shilshole area. Appendix B provides a list of the marked sea

lions that have been resighted in Shilshole Bay more than once since marking. Sixty-seven marked sea lions (26%) have been observed at Shilshole Bay multiple times since they were captured and marked. Of the marked sea lions with multiple resights in Shilshole Bay, only 19 sea lions (7.5%) were seen at the Locks subsequent to marking (see Appendix B). These data indicate that only a small number of the sea lions that have occurred in the Shilshole area enter the Locks area. During the 1994/95 season, only seven (3%) of the 248 marked sea lions (#'s 41, 45, 48, 58, 87, 212 and 225) were resighted in the Locks area during the steelhead run (Foley 1996). Only one additional marked animal (#118) was observed at the Locks during the 1994/95 season, but it was sighted in late June after the steelhead season.

The studies by Gearin et al. (1995 and 1996) show that California sea lions are highly mobile along the west coast. The 210 sea lions marked during the 1994/95 season at Shilshole Bay were tracked during the southward migration by conducting surveys along the migration route at known haul-out sites or on the California Channel Islands rookeries of San Miguel or San Nicolas Island. The last sightings of individuals in Puget Sound during late April or May were recorded and the first arrival of sea lions observed along the Oregon coast or the Channel Islands was recorded. These data allowed researchers to calculate the travel times of individuals during the south migration. Two sea lions travelled from Shilshole Bay to Cape Arago, OR (a distance of 685 km) in 7 days. The travel times of 8 individuals from Shilshole Bay to San Miguel Island were less than 25 days and 2 sea lions made the 2,200 km trip in 17 days. The mean travel time from Puget Sound to San Miguel was 37 days based on a sample of 57 sea lions which were observed in late April and May prior to the onset of the south migration (Gearin et al. 1995). Sea lion #17, which is the only sea lion captured at Shilshole Bay that was instrumented with a PTT satellite linked transmitter in 1995, made the south migration in 18 days and had a maximum 1 day travel distance of 177 km (110 miles). One sea lion (#63) migrated back to California in the winter. Sea lion #63 was observed in Puget Sound on November 26, 1994 and subsequently observed in San Francisco Bay on December 13, 1994, a maximum travel time of 17 days. These new data demonstrate the mobility of California sea lions and further demonstrate that translocation of this species is not a practical or prudent alternative for removing California sea lions from the Ballard Locks as described in NMFS and WDFW (1995). Previous studies on translocation of individuals from Shilshole Bay to the outer Washington coast have demonstrated that most animals quickly return to the locations where they were captured (NMFS and WDFW 1994). Animals appear to exhibit a strong homing tendency when translocated prior to the migration period. As shown in Appendix A, four sea lions (#21, #22, #41, #43), which were translocated from Shilshole to southern California in 1990, returned to northwest waters within 30-45 days after their release even though they were released just before the southward migration

would normally occur. These 4 animals quickly departed Puget Sound within several weeks of their return and migrated south again. The homing instinct or migration trigger mechanism is unknown but may be related to hormonal activities and/or may be biochemically programmed.

IV.F. Sea Lion Occurrence in the Inner Bay in 1994/95

Foley (1996) describes the results of the monitoring program at the Locks in 1994/95. Monitoring of sea lion occurrence and predation began on December 5, 1994 and continued to June 17, 1995 for a total of 188 days of monitoring. Sea lions were observed in the Locks area on 117 days (62% of the days monitored). Sea lion abundance in the inner bay in 1994/95 was lower than in 1993/94 and both years were substantially below the levels seen in previous years (Foley 1996). The reduced sea lion abundance in both years could have been caused by the very weak steelhead return, operation of the acoustic barrier, or a combination of the two. In order to monitor occurrence of sea lions within the inner bay area, the area was subdivided into 10 observation zones (see Figure 5). The acoustic devices were arranged to "ensonify" zones 1-4, which is the area below the dam in front of the fishway where steelhead are most vulnerable to predation. The majority, approximately 46%, of the time spent by sea lions in the inner bay was spent in the ensonified zone (zones 1-4). The area near the large lock (zones 8 and 10) had the next highest total with approximately 35%, followed by about 20% in zones 5, 6, 7 and 9 (Foley 1996).

Seven marked sea lions (#'s 41, 45, 48, 58, 87, 212 and 225) were observed in the inner bay in 1994/95; three had been marked in previous years and four were marked during the 1994/95 season. These animals accounted for approximately one-third of the hours of observed sea lion presence during the season (Foley 1996). The remaining two thirds were observations of unidentifiable sea lions. These unidentified sea lions could have been marked animals, but the marks were not seen. Four of the marked sea lions were observed in the inner bay on only one or two days (#41 - 2 days; #48 - 1 day; #58 - 1 day; #212 - 1 day). The other marked sea lions were observed on multiple occasions (#45 - 6 days; #87 - 13 days; #225 - 9 days). Inner bay distribution patterns were similar for marked sea lions as for total sea lion presence, i.e., 55% in the ensonified zone, 31% near the large lock, and 14% in zones 5, 6, 7, and 9. Only two of the marked sea lions (#41 and #225) were observed killing steelhead in 1994/95. These two marked sea lions were responsible for most of the observed steelhead predation. Sea lion #225 killed three of the six steelhead observed, and one was killed by sea lion #41. Following the steelhead run, observations on sea lion behavior in the presence of the acoustic barrier continued during the

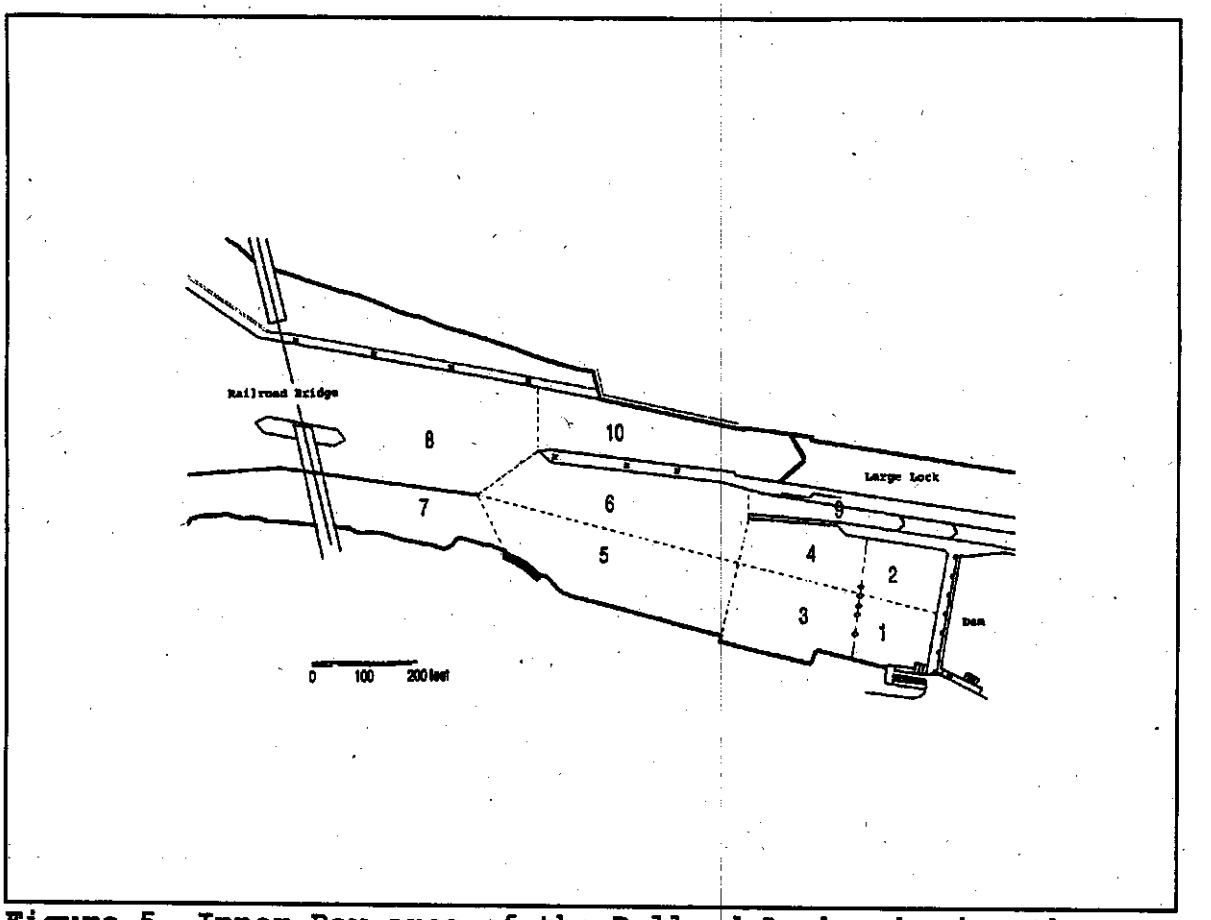

Figure 5. Inner Bay area of the Ballard Locks showing the delineation of the Observation Zones 1-10. Zones 1-4, in front of the dam are the "ensonified zone" when the acoustic devices are operating.

downstream smolt outmigration in May and June. These observations are discussed in Section IV.J.

Other sea lions that have been observed successfully foraging on salmonids at the Locks in past years are shown in Table 3. However, only sea lion #'s 17, 41, 45, 87 and 225 have been observed preying on returning salmonids during operation of the acoustic devices. Sea lions #87 and #45 were observed eating sockeye salmon in the inner bay during operation of the acoustic barrier in June 1995. Sea lion #45, #87 and #225 returned to the Locks to forage during the coho salmon run in fall 1995. Sea lion #87 was also observed taking chum salmon following the coho run. Sea lion #17 was placed in captivity during the 1994/95 steelhead run and had no opportunity to prey on salmonids; however, in 1992/93 and 1993/94 this animal was the principal predator at the Locks during use of the acoustic devices. In January 1996, sea lion #17 was observed killing unidentified salmonids in the Locks area during operation of the acoustic

TABLE 3. Marked California sea lions that have been observed in the Locks area and observed preying on steelhead.

I.D. Number	Number of Days Observed at Locks	Steelhead Predation Observed	Last Sighting at Locks
1	10	yes	Feb. 1989
2	4		(dead 2/15/89)
6	3	yes	Feb. 1990
7	1		Mar. 1989
8	1		Dec. 1989
9	3		(dead 1/30/94)
11	1		Apr. 1989
12	1		Dec. 1989
15	19	yes	(dead 2/1/90)
16	1		Apr. 1989
17	133	yes	Jan. 1996
19	71	yes	Apr. 1990
21	1		Mar. 1989
23	10	yes	Feb. 1990
24	1		(dead 6/23/89)
25	138	yes	Nov. 1990
28	1		Apr. 1989
29	1		Apr. 1989
30	23	yes	Apr. 1990
31	1		Mar. 1990
32	5	yes	Nov. 1993
34	3	yes	Apr. 1989
38	42	yes	Apr. 1989
41	42	yes	Feb. 1995
42	88	yes	Apr. 1991
45	13[1/]		Jan. 1996
48	1		(dead 3/6/95)
58	1		Jan. 1995
87	13[2/]		Jan. 1996
118	2		Jun. 1995
212	1[3/]		May 1995
225	9[4/]	yes	Jan. 1996

[1/] #45 was observed preying on smolts and adult sockeye and coho salmon at the Locks in 1995.

[2/] #87 was observed preying on smolts and adult sockeye, coho and chum salmon at the Locks in 1995.

[3/] #212 was observed preying on smolts at the Locks in 1995

[4/] #225 was observed preying on smolts and adult coho at the Locks in 1995

devices. Sea lion #17, #32 and #45 were the only marked animals observed at the Locks during the 1993/94 steelhead season. Both #17 and #45 have foraged in the Locks area in spite of the acoustic devices. However, sea lion #32, which was observed killing a steelhead at the Locks in 1990, has not been resighted at the Locks since installation of the acoustic barrier in January 1994.

IV.G. Sea Lion Predation Control Efforts in 1995

During the 1994/95 steelhead run, a predation control program was implemented using a combination of non-lethal deterrence with acoustic devices, firecrackers, boat hazing, and capture and removal to temporary captive holding or translocation. Lethal removal, which was available as a last resort if captivity was not feasible or practicable, was not implemented in 1995. These measures were implemented in a phased approach with deterrence measures used to prevent most animals from accessing the areas where previous years' predation rates were observed to be high. Under the phased approach, an acoustic barrier was installed below the dam to deter sea lions from the fishway area. Additional deterrence measures such as firecrackers and boat hazing were applied to sea lions that penetrated the barrier and remained in the ensonified zone. Individually identifiable sea lions which penetrated the barrier or had killed steelhead were targeted for capture and removal. In accordance with the Letter of Authorization, the lethal removal "trigger" would be reached if the predation rate exceeded the 10% of the available steelhead.

The lethal removal "trigger" was reached on January 24, 1995, when during a seven day period, two steelhead were tallied on the fish counter and one steelhead was observed taken by a sea lion. On January 25, sea lion #17 was captured and placed in captivity. On April 2, 1995 steelhead had been tallied on 14 days since the last observed predation had occurred (on February 8) and the lethal removal authority ceased and was not reinitiated as no further predation on returning steelhead was observed. On May 24, sea lion #225 (which had killed 3 steelhead on February 8 and had been observed foraging within the ensonified zone) was captured and translocated to the Strait of Juan de Fuca. On June 13, sea lion #87 (observed foraging repeatedly within the ensonified zone) was captured and translocated to the Strait of Juan de Fuca. Both of these sea lions had been candidates for capture and temporary holding early in the season; however, they were not observed hauling-out on the trap until June (after the steelhead run) and were relocated to the Straits in an attempt to prevent them from continuing to successfully forage on smolt and sockeye in the ensonified zone. Nonetheless, sea lion #87 and #225 returned to the Locks in three and eight days respectively of their release into the Strait.

A number of sea lions penetrated the acoustic barrier and remained in the ensonified zone for periods of up to several hours. However, as in 1994, no steelhead were observed killed in the ensonified zone in 1995. Because of the continuing low run size, it was not possible to determine if the lack of predation within the ensonified zone is attributable to the acoustic devices or is an artifact of the low run.

Total losses of winter steelhead by sea lion predation were

estimated for both the inner and outer bays by calculating daily predation rates for two week periods between December 5, 1994 and May 31, 1995 (Foley 1996). Total estimated predation losses were 11 wild fish and one hatchery fish based on six observed mortalities in the inner bay and two in the outer bay. Of the six observed kills in the inner bay, two were killed by sea lion #225 on February 8, 1995 (one in zone 5 and one in zone 10) and one was killed by sea lion #41 on February 4 (in zone 8). These fish were caught by sea lions when the acoustic barrier was operating, but were not taken in the ensonified zone (zones 1-4). The other three steelhead observed killed in the inner bay were taken by unidentified sea lions, which may have been marked but the marks were not observed. One steelhead was killed in zone 1 during the timeframe when the acoustic devices were damaged and inoperable. The other two steelhead were killed by unidentified sea lions in zones 6 and 10 (outside the ensonified zone) when the devices were operating. Two steelhead were observed killed in the outer bay area, one was taken by #225 on February 8, and the other was taken by an unidentified sea lion.

IV.H. Captive Holding in 1995

As outlined in the January 4, 1995 Letter of Authorization, WDFW contacted aquariums and zoos in the Northwest to determine the availability of suitable holding facilities for temporary husbandry of sea lions for up to five months or until the conclusion of the winter run. As part of the authorization, NMFS provided funding for WDFW to test the feasibility of temporary captive holding of wild adult male California sea lions, without domestication, as a mitigation measure. The facilities needed to be able to isolate the captured sea lions from public viewing in order to minimize, as much as possible, any interactions with people. Alternate facilities, such as net pens, swimming pools and military facilities were also investigated, but were found to be infeasible. No suitable existing facilities were found to be available on the west coast; however, two local public display facilities expressed an interest in modifying their facilities to temporarily hold the adult male sea lions, but only if full funding for staffing and the necessary structural changes was provided. Accordingly, WDFW contracted with Point Defiance Zoo and Aquarium (PDZA) in Tacoma, WA to construct a suitable temporary holding enclosures (including tanks, dry haul-out area and fencing). Final cost for construction and modifications necessary for the holding enclosures was $67,000. PDZA agreed that the enclosures would be available for exclusive WDFW or NMFS use for the next three years and it further was agreed that any sea lion held at PDZA would be released alive at the end of the holding timeframe each year.

In the interim period of constructing the holding enclosures at PDZA, WDFW modified a fish hatchery raceway to serve as a temporary sea lion kennel. Construction of the new temporary

holding area, which was designed to house six to eight sea lions, was completed on May 8, 1995 (Jeffries and Wilson 1995).

As required by the authorization, WDFW established an Animal Care Committee (ACC) consisting of marine mammal biologists, veterinarians, and animal husbandry experts approved by NMFS (Jeffries and Wilson 1995). The ACC was responsible for providing recommendations on captive holding facilities, health screening, veterinarian care, blood work, feeding, and euthanasia protocols. On February 1, 1995, the ACC met formally to review the captive holding protocol and provide guidance on nutritional and medical needs and on extended term holding enclosures.

On January 25, 1995, with the lethal removal "trigger" in place, sea lion #17, an individually identified "predatory" sea lion, was captured for temporary holding in captivity. The sea lion was initially held in a temporary dry enclosure and in transport containers while the kennels (chain-link fence enclosures) were being installed in a hatchery facility raceways. Based on protocols developed by the ACC, sea lions could be held for up to seven to ten days without feeding, provided fresh water was given in the enclosure. On February 2, #17 was transferred into the kennel in the hatchery raceway and the feeding protocol recommended by the ACC was immediately implemented (Jeffries and Wilson 1995). Feeding was initiated using live steelhead smolt (smolt were the only live freshwater prey readily available), followed by dead herring. The animal began accepting the dead fish immediately.

At the time of capture, #17 weighed 872 pounds. The animal was fed 26 to 40 pounds (3.2% to 4.4% of body weight) of herring per day supplemented with salt and multiple vitamins for the duration of captivity (Jeffries and Wilson 1995). On February 24, the sea lion's weight had increased to 892 pounds, and 935 pounds on March 13. When transferred to the new holding facility at Point Defiance Zoo and Aquarium (PDZA) on May 8, #17 weighed 966 pounds. At the time of release on June 8, #17 weighed 1082 pounds (Jeffries and Wilson 1995). This weight gain is considered normal for adult sea lions during the months leading to the breeding season. At one point during captivity, #17 refused to eat when the type of herring (Pacific verses Atlantic) was changed. Captive pinnipeds are known occasionally stop eating for short periods when food is changed. When the original type of herring was again offered, #17 began eating again. After this occurrence, the animal was offered (and ate) a mixture of both types of herring for the duration of captivity. Veterinary and blood work indicated that #17 remained in good condition during captivity despite a broken canine tooth and titre for Leptospira bacteria (Jeffries and Wilson 1995). The cost of food and care for this one sea lion was about $45 per day and totaled about $6,075 for the 135 days of captive maintenance (Jeffries and Wilson 1995). However, these costs could have been substantially higher if there had been any animal health or

holding complications. It is likely that handling, food, animal health and caretaking costs would have been much greater on a per animal basis if multiple sea lions had been held in captivity.

Because of concern for releasing a known predatory animal back to the environment and the potential that the animal would return to the Locks in the future, NMFS sent letters of inquiry to all known marine mammal captive display facilities in the U.S and abroad on May 8, 1995. The letter requested information from the display community on the availability of a permanent captive holding facility which would be willing to receive and care for captured sea lions which would otherwise be eligible for lethal removal. Several facilities responded, but did not have an interest nor available space or resources to assume permanent captive holding of sea lion #17 or any other large adult male California sea lion from the Locks.

Before release, #17 was fitted with satellite and radio transmitters to allow for monitoring the animal after release. This was done to determine if the extended stay in captivity may have resulted in behavioral changes or anomalous behavior. On June 8, #17 was released in the Strait of Juan de Fuca, west of Port Angeles, WA (Jeffries and Wilson 1995). The satellite transmitter allowed biologists to track the animal's movements south out of Washington waters. On June 26, 18 days after release, #17 arrived at San Nicolas Island, California where he remained until the beginning of August. Sea lion #17 was not visually sighted on San Nicolas Island, but the satellite fixes indicate that this animal was not a territorial sea lion. Sea lion #17 arrived on San Nicolas on June 26 and spent approximately 2 days onshore before going to sea for 1 day. The animals pattern continued through July in which he spent 1-4 days onshore and 1-2 days at sea. Territorial males will defend territories for 2-3 weeks without going to sea to feed; it is unlikely therefore, that animal 17 held a territory during the 1995 breeding season (Gearin et al. 1995). By mid-August, #17 was off the coast of Oregon and in mid-September was in Barkley Sound on Vancouver Island. Sea lion #17 was observed in Shilshole Bay on November 26, 1995, and on January 10, 1996 was observed foraging in front of the fishway within the ensonified zone at the Locks. Sea lion #17 was observed killing unidentified salmonids, possibly steelhead, in the inner bay in January 1996.

IV.I. Acoustic Barrier - Sound Level Measurements

The acoustic barrier installed at the Locks for the 1994/95 season consisted of two separate systems which operated independently from one another. The omni-directional acoustic devices, which hang from the safety cable about 35 to 40 yards downstream of the fishway entrance, were installed and activated on November 30, 1994. The directional devices, which sit on the

bottom downstream of the stilling basin apron, were installed and activated on December 9, 1994. On December 19, the acoustic devices were extensively damaged by high spill flows. The directional array was swept away in the current and the omni-directional array suffered broken cables. The damaged omni-directional equipment was removed for repairs and reinstalled on January 4, 1995. The directional array was salvaged by divers on January 5, repaired and reinstalled on February 3. Except for this incident and a number of short duration interruptions caused by equipment failure, the acoustic array was operated 24 hours per day through August 2, 1995.

The acoustic barrier in 1994/95 consisted of eight omni-directional transducers deployed in four pairs and three directional transducers deployed on the bottom beneath the omni-directional units. This is twice the number of transducers as were deployed during the 1993/94 steelhead season, but the units were paired so that the timing of the signals was the same as reported in Norberg and Bain (1994). According to the manufacturer, pairing the transducers reduced the sound level produced by each individual transducer by up to 3 $dB_{(RMS)}$ re 1 μPa at one meter. However, the added surface area and greater number of sound sources increased the likelihood that sea lions would be in closer proximity to an operating unit, and therefore potentially exposed to higher sound levels, if they remained in the ensonified zone (observation zones 1-4) for any length of time.

To determine potential levels of exposure and obtain further information on the ensonification of the Ship Canal by the barrier, additional calibrated measurements of the sound field produced by the barrier were conducted in 1995. Measurement techniques followed those described in Norberg and Bain (1994). The number of recording stations was increased and the area of coverage expanded to allow location of the 120 dB contour and the distance at which the acoustic barrier sounds fade into the ambient noise of Puget Sound (Bain 1996). The 120 dB contour has been used as a "rule of thumb" for the distance at which noise is likely to affect approximately 50% of marine mammals (ARPA 1995).

The highest sound levels within one meter of the surface, up to 177.7 $dB_{(RMS)}$, were encountered within 10 meters of the safety cable, although similar levels were encountered beyond ten meters along the south central transect line (Table 4a). Measurements near the cable, taken at mid-water levels were 10 to 15 dB higher than at the surface and the highest measurement, 190.0 $dB_{(RMS)}$, was recorded one meter from the cable at mid-water (Table 4b). Sound levels near the surface tended to be lower along the north side of the channel between the safety cable and the railroad bridge (Bain 1996). In the 1995 configuration, a sea lion approaching near the surface along the north side may never be exposed to a sound level over 165 dB, despite the use of transducers with

TABLE 4a: Sound levels as a function of distance from the acoustic barrier, as measured one meter below the surface (Bain 1996).

Distance (meters)	Transect/Location ($dB_{(RMS)}$ re 1 µPa @ 1 m) North	N.Central	Central	S.Central	South
1.0	170.9	167.6		175.5	174.7
4.0	165.9	156.0		177.7	173.8
5.6	171.3	156.1		174.6	174.1
8.0	170.4	156.1		174.4	170.8
11.3	166.8	163.1		171.8	168.7
16.0	165.0	161.0		177.2	169.3
22.6	164.8	163.9		173.9	168.3
32.0	162.4	167.1		170.2	164.9
45.0	156.6	161.6		169.0	164.8
64.0	158.8	161.5		163.5	167.2
90.5	146.1		161.7		164.3
128.0	155.8		157.7		159.6
181.0	153.3		157.2		158.8
256.0	138.1		149.4		152.2
362.0	143.1		143.4		143.2
512.0	129.2		135.9		129.0
724.0	119.4		143.8		132.2
1024.0	114.2		109.0		ambient
1448.0	ambient		ambient		ambient
2048.0	ambient		ambient		ambient

TABLE 4b: Sound levels as a function of distance from the acoustic barrier, as measured at mid-water (Bain 1996).

Distance (meters)	Transect/Location ($dB_{(RMS)}$ re 1 µPa @ 1 m) North	N.Central	Central	S.Central	South
1.0	173.9	190.0		178.6	174.9
4.0	172.6	183.7		175.6	172.1
5.6	172.1	177.2		173.6	174.0
8.0	168.8	176.2		174.7	172.8
11.3	169.4	174.3		172.6	172.7
16.0	168.6	169.7		171.6	170.7
22.6	168.0	171.1		173.4	168.9
32.0	164.0	166.3		170.7	166.4
45.0	161.8	169.5		168.9	164.8
64.0	159.1	166.7		165.9	164.4
90.5	153.9		157.7		165.2
128.0	156.8		160.5		163.3
181.0	155.8		155.6		158.2
256.0	141.8		150.6		152.6
362.0	145.3		142.0		142.7
512.0	123.7		139.2		125.2
724.0	116.7		142.0		123.8
1024.0	ambient		112.3		113.6
1448.0	ambient		ambient		ambient
2048.0	ambient		ambient		ambient

source levels of 193 to 206 $dB_{(RMS)}$. However, a sea lion approaching at mid-water within the beam of a directional transducer would be exposed to 165 dB or higher beginning 100 meters from the transducer (Bain 1996).

The analysis by Bain (1996) indicates the importance of the contributions made to sound levels by the directional transducers. Surface sound levels were found to increase with distance on the north central transect, presumably as the line moved into the beam of an operating directional transducer, before declining again beyond 32 meters. Sound levels appeared fairly constant over this range along the south central transect. Sound levels along the north and south transect decline fairly steadily.

In mapping the sound level contours below the dam, Bain (1996) noted that the signal drops off more rapidly beyond 250 meters. There is a shallow ledge that blocks much of the channel at a distance of about 230 meters, and the deep water channel is offset to the north. This obstruction severely limits the aperture for straight line transmission. Relatively high (>140 dB) sound levels were maintained where straight line transmission was possible, but signal levels dropped rapidly outside this path. Sound levels dropped to the point that ambient noise began masking the signal beyond 1400 meters (near the Azteca Restaurant at the entrance to the Ship Canal) and the signal was completely lost at a distance of two kilometers near the entrance bell buoy.

For the 1995/96 season, NMFS has obtained additional experimental acoustic equipment, with similar source levels, for testing in the area of the large locks that is "shaded" from the existing acoustic array due to the lock wall structure. The experimental equipment can generate sounds at both 10 kHz and 17 kHz and will be installed to expand the area of intense ensonification to include the entrance to the large lock. Observations are planned to evaluate the relative effectiveness of the two frequencies in deterring sea lions from entering the large lock area (zone 10).

IV.J. Sea Lion Predation on Salmon in Inner Bay in 1995

Steelhead are one of six salmonid species that pass through the Locks facility to enter the Lake Washington drainage. The coho salmon run, peaks in September/October just prior to the steelhead run. Following the winter steelhead run, juvenile salmonids (salmon and steelhead smolts) begin their outmigration to Puget Sound and adult sockeye salmon begin returning through the fishway. Based on fish tracking studies conducted on coho salmon and steelhead, both salmon and steelhead are known to use the locks as well as the fishway to ascend to Lake Washington (Roger Tabor, USFWS, pers. comm. 1996). California sea lions are present in Puget Sound and have been observed at the Locks

through these periods.

To determine whether "predatory" sea lions exhibit the same foraging behavior in the Locks area during operation of the acoustic devices during the steelhead run as compared to other times of the year when other salmon are migrating, the sea lion predation monitoring program at the Locks was expanded in 1995 to include observations during the downstream smolt migration, early adult sockeye salmon migration (through late June), and the fall coho salmon migration. In May 1995, following the normal sea lion/steelhead observation period, observers remained at the Locks through the smolt outmigration period in June which overlaps the beginning of the sockeye salmon run. In October, the observers returned to the Locks to collect observations during the coho salmon run. The fall observations were included in a pilot study to examine the effectiveness of the acoustic barrier on predation when large numbers of salmonids were present. Observations during the coho salmon migration were made during two periods; September 26 through October 4, and October 27 through November 8.

Following the steelhead run, observations on sea lion behavior in the presence of the acoustic barrier continued during the downstream smolt outmigration in May and June. During the peak of the smolt migration in mid-May, sea lion attendance in the inner bay was at its highest level for the entire spring season (Foley 1996). The acoustic barrier was in operation during the entire smolt outmigration period. Nonetheless, sea lion #45, #87, #212 and #225 were observed preying on smolt mostly within the ensonified zone. Sea lions were foraging in the ensonified zone between 50% and 60% of the time that they were present in the inner bay from mid to late May. These data demonstrate that certain sea lions will forage at the Locks when salmonids are available, even within the area where acoustic ensonification is the most intense. Sea lion #87 and #45 also were observed eating sockeye salmon in the inner bay during operation of the acoustic barrier in June 1995. However, the observation program ceased in mid-June well before the peak in the sockeye run, and therefore the data on sockeye predation are incomplete.

Initial observations during the fall coho salmon season totaled approximately 44 hours from September 26 to October 4. Coho returns during this period were on the order of 100 to 150 fish per hour. The acoustic barrier was off during this period. The results of the observations are shown in Appendix C. Two marked sea lions (#87 and #225) were observed in the inner bay during this period. There were 19 additional sightings of unidentified sea lions that were not, or could not, be identified as marked. A total of 38 coho were observed killed by sea lions upstream from the railroad bridge: five on the lake side of the dam; 19 in zones 1-4; and 14 in zones 5-10. One additional coho was observed killed west of the railroad bridge. Of the coho killed in the inner bay (zones 1-10), 58% were killed in zones 1-4, and

42% in zones 5-10. However, five of the 14 kills in zones 5-10 occurred in zone 10 (in front of the large locks) during elevated spill conditions. Fifteen coho were killed by #87 and the remaining 23 by other sea lions. There were no observed coho kills by #225 during this period. Sea lions were present each day except one of the seven days observed. Sea lion #87 was present in the inner bay on two of the seven days (September 28 and 29). On September 28, #87 was observed taking eight coho during a three hour period. These coho were all taken in zone 1 adjacent to the fish ladder. Although #87 was the sole animal observed to kill coho on this date, one to two additional sea lions were present in the inner bay when the kills were observed. The following day, September 29, an unmarked sea lion was already foraging in zones 1 and 2 when observations began. This animal was observed to kill a coho in zone 2 during the morning. At 11:35 a.m., sea lion #87 returned to the inner bay and began foraging near the fish ladder. The unmarked sea lion left the inner bay shortly after the arrival of #87, and did not return for the rest of the day. Sea lion #87 consumed seven coho on the 29th, of which five were taken in zones 1-4 and two were taken in zone 10.

An additional 66 hours of observations were undertaken during the period between October 27 and November 8. Coho abundance was lower, on the order of 10 fish per hour during this monitoring period. The acoustic devices were installed and the acoustic barrier was operated on five of the nine days observed. The results of the observations are shown in Appendix D. Two marked sea lions (#87 and #45) were observed in the inner bay during this period. Fifteen additional sightings of unmarked or unidentified sea lions also occurred. A total of 21 coho salmon were killed by sea lions during this observation period. Seventeen coho (81%) were taken in zones 1-4 (8 with the acoustics off and 9 with the acoustics on) and four fish (19%) were taken in zones 5-10 (3 with the acoustics off and 1 with the acoustics on). Seventeen fish were killed by #87 (7 with the acoustics off and 10 with the acoustics on) and the remainder by other sea lions (all with the acoustics off). All of the observed coho kills during operation of the acoustic devices were by #87. Although other unidentified sea lions and #45 penetrated the acoustic barrier, none of them were observed to kill coho in the ensonified zone. There did not appear to be any discernable difference in foraging effectiveness for sea lion #87 whether the acoustics were on or off.

A total of 39 hours of observations were made with the acoustic devices on. Sea lions were present on three of the five days of observation. Sea lions were present in the inner bay for a total of 8 hours with the acoustics turned on (about 7 hours in zones 1-4 (ensonified zone) and 1 hour in zones 5-10). Ten coho were observed killed during this period (9 in zones 1-4 and 1 in zones 5-10). All of the observed fish kills during the on period were made by sea lion #87.

A comparison of sea lion inner bay residency time between animals that have been observed a number of times at the Locks, foraging in the ensonified zone (#87 and #45), and other animals which are yet to be identified gives an indication of the effectiveness of the acoustic barrier. Sea lion residency time (the cumulative total time spent by sea lions (separate sightings of marked, unmarked or unidentified sea lions) in the inner bay) totaled about 24 hours (15 hours with the acoustics off, and 8 hours with the acoustics on) during the October/November observations. Sea lions #87 and #45 accounted for 12.07 hours (50%) and the remaining unidentified animals accounted for 11.89 hours (50%). Sea lion residency time in the inner bay totaled about 16 hours when the acoustic devices were off. Sea lion #87 accounted for about 5 hours (30%) and unmarked or unidentified animals accounted for the remaining 11 hours (70%). Sea lion #45 was not observed when the devices were off. Sea lion residency time in the inner bay totaled 8 hours when the acoustic devices were turned on. Sea lions #87 and #45 accounted for 7.25 hours (91%) and the remaining unmarked or unidentified animals accounted for 0.75 hours (9%). Following the observation period, the acoustic devices were turned off until reactivation on December 4, 1995 when the 1995/96 steelhead season observations began.

IV.K. Winter Steelhead in Lake Washington

A description of the winter steelhead life history is provided in the 1995 EA (NMFS and WDFW 1995). The 1995/96 run forecast is estimated to be 146 steelhead based on the revised preseason estimation methodology that uses proportionate averages of returns by age class over the last four years. WDFW began using this revised preseason estimation methodology last year to forecast the steelhead run size as it relies more heavily on recent information to capture recent trends in abundance. The 1995/96 run is comprised primarily of the progeny from the 1990/91 and 1991/92 brood years when escapements exceeded 200 fish. Following the 1995/96 run, future runs will likely decline to very low numbers as the more recent brood years with extremely low escapements become predominant. For example, applying the current forecast methodology to the 1996/97 run results in an estimated total run of only 90-100 steelhead (if there is no predation).

Lake Washington winter steelhead were included along with 177 other west coast steelhead runs in a petition by ONRC et al. (1994) to list steelhead under the Endangered Species Act (ESA). A NMFS finding on the status of west coast steelhead under the ESA is pending. Nehlsen et al. (1991) included Lake Washington winter-run steelhead as being at moderate risk of extinction. The Lake Washington winter steelhead population is considered to be a depressed native wild run in the current Washington salmonid inventories (WDFW 1994, WDFW 1995a). Genetic analysis by Phelps et al. (1994) indicates that Lake Washington wild winter-run

steelhead are distinct from hatchery fish which have been planted in the system in the past to augment sport and tribal commercial fisheries. Hatchery fish are no longer being planted in the system because of concern over the low numbers of wild fish, and steelhead fisheries have been closed to protect returning wild spawners.

Lake Washington winter steelhead are important as part of the larger Puget Sound steelhead population. The National Research Council (NRC 1995) emphasized the importance of local breeding units within metapopulations as the fundamental unit of replacement for anadromous salmon. Incremental loss of components of a metapopulation is a concern because each loss diminishes the scope of genetic variation. The genetic variability within a population represents the reservoir upon which future evolutionary development depends. It is therefore pertinent to consider the status of the Lake Washington stock relative to threshold escapement levels. Although there is no conclusive analysis of critical escapement levels for steelhead or other anadromous salmonids, the question of threshold was addressed by the Biological Requirements Work Group (BRWG 1994) for Snake River salmon listed under the ESA. The Work Group determined that it was not feasible to define a threshold level corresponding to pseudo-extinction (a level below which continued survival is precluded). However, the Work Group did seek to define escapement levels below which continued survival appears to be highly uncertain, based on considerations of demographic factors, environmental variability and genetic considerations. The BRWG suggested escapement thresholds of no fewer than 150 naturally spawning adults annually for "smaller" populations and 300 for "larger" populations. The distinction between "small" and "large" depends on maximum sustainable production levels, spawning area and historical population levels. It is unclear whether Lake Washington steelhead would be designated as small or large within this context. However, because the abundance of returning adult steelhead has declined to such precariously low numbers it is necessary to protect as many of the few remaining spawners as possible to maximize the potential for recovery.

The escapement of Lake Washington steelhead over the last 3 years has been 184, 70 and 126. The projected escapement for 1995/96 is 146 if no sea lion predation occurs. Progeny from these very low spawning escapements will start returning in 1996/97 (next year) when the total run size may be less than 100 steelhead. As returns from these depressed brood years begin to comprise the majority of the run, the number of returning adults is expected to decline further. The Lake Washington population is therefore at or below the critical threshold level defined for "small" populations and thus, relative to the BRWG recommendations are at the point where continued survival appears to be highly uncertain.

IV.L. Long Term Steelhead Enhancement and Management Planning

In addition to measures being taken to protect returning adult steelhead from predation by sea lions, resource agencies are also involved in long-term habitat conservation and enhancement efforts, fisheries management activities, fish passage improvements for both adult and juvenile salmonids, and supplementation efforts for recovery of the Lake Washington winter steelhead population. A summary of those efforts is described below.

Fishery Management Activities

All fishing on steelhead, both tribal and sport fisheries, are closed in the Lake Washington system including the estuary. Prior to the suspension of hatchery planting in the drainage, fisheries were managed to focus on the earlier hatchery returns and wild fish release regulations were in place for the protection of wild fish. In recent years, however, hatchery supplementation of the run to provide fishing opportunities has been discontinued owing to concern for genetic introgression into the wild strain if hatchery returns were not caught. Fisheries have been closed to preclude interception of wild steelhead.

Adult Fish Passage

As indicated in Section IV.B. above, in response to recommendations from the Work Group, the Corps of Engineers installed a new fishway control module in 1995 as a short term measure to improve the regulation of attraction water flows. In support of long term planning efforts, the Corps designed and is installing a new automated fishway control system in 1996. The new system will provide the needed flexibility to accommodate future test regimes and fishway improvements when implemented.

The Corps has also adopted an amended lake level operating curve to provide spill over the dam throughout the steelhead run to maximize adult fish attraction to the fishway. The amended operating curve allows for additional water storage for use during the juvenile fish out-migration as described below.

Downstream Smolt Passage

The smolt slide (see IV.B.) which was tested in 1995 will again be installed for further evaluation in 1996. The slide has been modified to increase operational flexibility. It is anticipated that use of the slide will enhance smolt passage by attracting out-migrants away from the locks chambers and toward a safer continuously operating exit.

Mini-flushing which was being evaluated as a water conservation and salinity control measure has been discontinued during the spring outmigration period. Mini-flushing may have contributed

to smolt injury by increasing the likelihood of smolt passage through the lock plumbing.

Water sprinkler systems have been installed at the downstream end of the lock chambers to limit bird predation on exiting smolts. Bird wires were installed over the spillway area to discourage predation on smolts by gulls. The sprinkler systems and bird wires will be employed in 1996 and for the foreseeable future.

The Muckleshoot Tribe has recently informed the Corps of their interest in sponsoring a project under Section 1135 of the Water Resources Development Act to provide safer smolt passageways over the dam, discourage passage through more harmful routes, and monitor the effectiveness of both.

The Interagency Work Group on Fish Passage was formed in 1994 to examine fish passage concerns (see Section IV.B.) and make recommendations. The Work Group is still active and plans further studies to quantify the use of various exit routes by smolts. These studies include hydroacoustic monitoring of the lock plumbing. Additional investigations of species composition and injuries are also planned. These additional studies are required to identify where and to what degree the facility may be impacting outmigrants and to provide information on which to base mitigation recommendations if warranted. To date, studies indicate that smolts may be injured by passage through the lock plumbing but there is no information on the overall numbers of smolts that pass through this route (i.e. although smolt injuries have been observed there is no way to quantify the significance of this observations because the sample size and bias are unknown).

Supplementation Plan

WDFW is drafting a supplementation plan for capturing and spawning broodstock. Several problems have to be resolved due to the small size of the run (146 spawners), such as how to efficiently/effectively capture broodstock and how many need to be captured.

Habitat

WDFW Wild Salmonid Policy Team has completed a draft Environmental Impact Statement and companion Summary Document (WDFW 1995b) for a State of Washington Wild Salmonid Policy. The proposed Wild Salmonid Policy provides general policy guidance for the protection, management, and production of wild salmonid fishes in the State. It covers protection of salmonid habitats, protection and maintenance of population sizes, conservation of genetic resources, and other factors affecting the long term survival and production of salmonids.

The Wild Salmonid Policy establishes goals for prioritizing

protection of wild salmonid habitat for migration, spawning and rearing. The goals include the identification and pursuit of mitigation for damaged or lost habitat as well as preservation and restoration of the natural hydrologic regime. Additional habitat goals include the establishment of instream flow regimes that meet the biological requirements of wild salmonids, management of watersheds so that sedimentation reflects natural levels and substrate conditions are maintained in favorable condition for spawning and rearing, and the protection of water quality to support balanced aquatic ecosystems. These goals are statewide and reflect commitment on the part of the State to the 'big picture' not just the Lake Washington drainage.

With respect to the Lake Washington basin, a Habitat Conservation Plan (HCP) is in development for the Cedar River watershed. This effort is being coordinated by the Seattle Water Department. The list of agencies involved includes NMFS, USFWS, WDFW, Muckleshoot Tribe, and King County. The HCP planning area includes the upper and lower Cedar River Watershed. Elements of the final HCP may include adult and juvenile fish passage facilities at Landsburg Dam for anadromous fish. Steelhead are a target species for this element and fish passage facilities would provide access to an additional 12.4 miles of mainstem Cedar River spawning and rearing habitat. The HCP may also include a negotiated flow regime for all species in the lower Cedar River. Steelhead spawning and rearing flows will be considered in the HCP. The final HCP should be completed in the near future.

A multi-agency research effort, called the Lake Washington Ecological Evaluation Program, is a five year program that began in late 1994. The Evaluation Program is targeted on various ecological studies in Lake Washington intended to determine possible reasons for the dramatic decline in sockeye salmon production in the Cedar River. Coordinated by WDFW, efforts include studies on carrying capacity, zooplankton, phytoplankton, predation, competition, water quality, and early life history studies. Although targeted on sockeye, information gained from the studies may provide a possible link to ecological changes in Lake Washington and declines in juvenile steelhead production and survival. NMFS is not directly involved in the studies but monitors their progress by participating in the HCP process.

King County Surface Water Management Division has several planning teams for various sub-basins in the Lake Washington basin (e.g., lower Cedar River, Issaquah Creek). End products for these teams will consist of sub-basin plans that will include anadromous fish and land use management approaches that should help insure the long-term health of all anadromous fish stocks and the Lake Washington Watershed as a whole. WDFW is involved in these efforts.

In addition, citizen groups are actively pursuing restoration of anadromous fish habitat throughout the Lake Washington Watershed.

Activities include the purchase of undeveloped properties along streams to maintain buffers, land trust agreements with property owners to preserve natural stream features, re-planting of native vegetation along streams to restore streamside cover, creation of wetland habitat, and restoration of stream channels through daylighting streams that had formerly been placed in pipes.

These long term efforts are ongoing and intended to secure the future for salmon and steelhead in Lake Washington and the State as a whole. However, if these efforts are successful and wild salmonid production is restored in Lake Washington, it will mean nothing for the steelhead if insufficient numbers of returning adults survive sea lion predation to spawn.

V. ENVIRONMENTAL CONSEQUENCES OF THE PROPOSED ACTION AND ALTERNATIVES

V.A. Alternative 1 - Take No Action to Modify the Conditions for Lethal Removal (Status Quo Alternative)

The no action alternative would continue the "status quo" which was previously assessed in the 1995 Environmental Assessment (NMFS and WDFW 1995). The "status quo" alternative allows lethal removal of "predatory" sea lions if a) non-lethal deterrence measures are attempted; b) a lethal removal "trigger" based on predation rate and fish availability is reached; and c) temporary captive holding facilities are unavailable or captive holding is infeasible or impractical. A "predatory" sea lion is an individually identified sea lion (i.e., an animal with a brand mark, tags, or other distinguishable natural marks) that has been observed preying on steelhead at anytime (including past years) in the Lake Washington Ship Canal. Facilities exist at Point Defiance Zoo and Aquarium to temporarily hold up to six sea lions for the duration of the steelhead run. However, WDFW has advised that funding for caretaking, food and medical costs for captive sea lions is not available.

A comparison of the definition of "predatory" sea lions under each of the four alternatives is provided in Section V.C.

This alternative increases the risk that the depressed steelhead run will continue to sustain avoidable predation losses. The "trigger" requires that steelhead predation must occur in order for lethal removal to be considered. The 1995/96 steelhead run is again projected to be very low (146 fish). Even at this low level, with the likelihood that run sizes over the next several years will decline to critically low levels, the 1995/96 run represents the last and best opportunity for a successful recovery program. Accordingly, the "trigger" requirement that predation must occur before lethal removal of predatory animals can occur will result in steelhead mortality which negatively

impacts the status and recovery of the winter steelhead population.

The potential for lethal removal of sea lions under this alternative is lower than the other alternatives because sea lions are to first be held in temporary captivity. If captivity proved unfeasible, this alternative would be similar to other alternatives in that lethal removal is unlikely to involve more than 5-10 predatory sea lions. Further, as an additional "safety valve" to prevent large numbers of removals, the current Letter of Authorization stipulates that if 15 sea lions are removed, the Task Force would be reconvened to review and evaluate the effectiveness of the measures implemented.

Temporary Captive Holding

This alternative requires temporary captive holding of sea lions for the duration of the steelhead run and then release back to the wild in late May or early June. Lethal removal is authorized only if 1) adequate holding facilities are unavailable, or 2) temporary holding is infeasible or impractical. This temporary captive holding condition was placed in the Letter of Authorization in 1995 because the Task Force identified captive holding as its highest priority and recommended that lethal removal not occur unless adequate holding facilities were not available (Task Force 1994). In 1995, only one "predatory" sea lion (#17) was captured and placed in captivity; other "predatory" sea lions were not available for capture (i.e., they did not haul-out on trap) during the steelhead run. Although there were no significant problems with the holding of #17 in captivity in 1995, there is still uncertainty as described in the 1995 Environmental Assessment on holding multiple wild adult male sea lions in captivity. There remain a number of unresolved risks with captive holding both to the animals and to people involved in caretaking, as well as the general public if the animals habituate to being near and fed by people (NMFS and WDFW 1995).

It was acknowledged by NMFS when this condition was placed in the Letter of Authorization that temporary captivity "is only a temporary solution to the problem because the animals would likely return in the next season and may be more difficult to capture" (see page 65 of 1995 EA). As predicted, recent data on the return of sea lion #17 indicates that temporary captive holding will not eliminate the predation problem at the Locks, because the animals will return following release. Further, not only has #17 returned to the Locks area and been observed killing salmonids in front of the fish ladder in the ensonified zone during the winter steelhead run, but the animal has <u>not</u> hauled-out on the trap and is hauling-out on buoys where he is inaccessible to capture. This new information on the return of sea lion #17 along with substantial data on the annual return of "predatory" sea lions to the Locks area demonstrates (see Section

IV.E. and Appendix A), as discussed below, that temporary captive holding requirement under the status quo is not a prudent and practical measure for eliminating the problem interaction at the Locks.

There are several issues pertinent to temporary captive holding and release back to the wild that make this approach unfeasible and impractical for addressing the sea lion predation problem over the longer term. The discussion below examines evidence along four lines that demonstrates the above conclusion. They are: 1) seasonal migratory patterns and movements of individual sea lions; 2) potential inability to recapture sea lions and impacts on steelhead during capture attempts; 3) effects of predatory sea lions on "naive" sea lions; and 4) human safety.

First, as shown in Appendix A and as documented in past reports (see Figures 3 and 4, Section IV.D.), California sea lions have a seasonal migratory pattern between California and Washington, and placing sea lions in temporary captivity is not expected to influence that behavioral pattern. Experience with sea lion #17 (described below) supports this expectation. Furthermore, as shown in Appendix A and as documented in past reports, most of the sea lions that forage at the Locks return year after year. An analysis of the sightings data at the Locks from Appendix A shows that 73% of the sea lions that killed a steelhead at the Locks returned in the subsequent year to forage at the Locks. As evidenced by sea lion #17, there is no basis to assume that captive holding eliminates the tendency for predatory sea lions to return to the Locks.

Second, since it is essentially a given that the sea lions will return, the problem becomes whether the sea lion can be captured again in subsequent years especially if it becomes "trap-shy." The consequences to the steelhead run of not re-capturing a "predatory" sea lion in subsequent seasons (especially in light of the decreasing run size) could be significant. Although NMFS and WDFW were successful in capturing and marking over 200 animals in a single season, the opportunity and ability to capture specific known individuals is very limited. Capture efforts are dependent upon animals using the haul-out upon which the trap is built. California sea lions are commonly observed "rafting" in Puget Sound either singly or in groups, and the lack of hauling-out on land or accessible structures make them "uncatchable" with the current trapping methods. Sea lion males are apparently capable or resting in groups in the water and not hauling out for days at a time. It is the recognition of this fact that precipitated the need for an "active capture" approach in the Letter of Authorization. However, to date, such active capture attempts have been unsuccessful (Gearin et al. 1988). Further, when dealing with individual "target" animals for capture, past capture attempts with that animal will likely affect its behavior. Once a "target animal" has been captured on the trap, its behavior is likely to change, making it either very

difficult or impossible to capture, simply because they have learned to avoid the capture operation. Some sea lions use the haul-out platform at night, and leave either at first light or immediately upon the approach of a boat. Such experience occurred with two sea lions in 1995 that were present and foraging in the Locks throughout the season but not available for capture. Hauling behavior is not a predictable behavior, and for some animals may not recur at all during a season or following initial capture. For example, in 1995, sea lion #87 was initially captured and marked on the trap in January but was not observed hauled out there again until June when he was captured and relocated. Sea lion #225 (originally identifiable by natural markings), which was responsible for 3 kills on February 8, 1995, did not haul out on the trap and become available for capture until the end of May even though the sea lion was observed at the Locks numerous times prior to capture. The inability to capture "target" sea lions and the impact of such on steelhead was evident in 1990 when captures were being conducted for translocation of 10 identifiable predators to California. Sea lions avoided the haul-out trap for a month before becoming available for capture (Pfeifer 1991). Once capturing began, the time available to complete capturing all known "prime predators" was limited to one week (owing to restrictions on pre-translocation holding). Not all of the predators became available for capture during the capture period and only six animals were ultimately translocated. Although predation rates dropped immediately following the removal of the six sea lions, predation rates quickly climbed back to pre-translocation levels because two of the principal predators were not captured and they resumed their foraging at the Locks (Pfeifer 1991). Three of the six sea lions which were translocated to California in 1990 (#17, #41, and #42) returned to prey on steelhead in subsequent seasons.

Third, the return of sea lions that had been temporarily held in captivity and their foraging behavior at the Locks has an impact on "naive" sea lions that are not involved in steelhead predation. Field observations indicate that "naive" sea lions will quickly learn to not react to the acoustic devices if these naive animals enter the area at the time that a "predatory" sea lion is penetrating the ensonified zone. "Naive" sea lions that approach the acoustic barrier normally turn and leave the area unless their behavior is affected by the behavior of "learned" sea lions. Because of this, there is a greater potential for replacement of predatory sea lions if the "repeat offender" predatory animals are not removed (permanently) as quickly as possible.

Fourth, there is risk to human safety. There is always a risk to the people involved in handling these animals. The more times the sea lions have to be captured and handled, the greater the risk to the WDFW and NMFS people involved in the captures. Over time, sea lions grow and reach a stage when their mass presents a

greater threat to human safety. Thus, safety concerns increase with capture in repeated seasons. Furthermore, just as some animals become trap-shy (avoid capture), they also may become more aggressive with repeated capture. This behavior cannot be generalized because individuals show a wide variety of response to human presence. Some become more docile with repeated captures, and others become more aggressive.

In summary, the above information, along with past data on repeated returns of certain sea lions to the Locks annually, indicates that captive holding, similar to relocation, is not a feasible or prudent non-lethal alternative to resolving the sea lion predation problem as this measure only provides short-term predation relief, with the likelihood of severe harm to the steelhead population, as well as increased human risk, when the released animals return the next year.

Temporary captive holding costs (not counting the costs of transportation, facility construction, security or maintenance) for one sea lion, which did not require special health care, exceeded $6,000 for the duration of the 1994/95 steelhead run. While the sea lion was in captivity, wildlife officials received threats and heightened security was required to protect the facility from vandalism and the animal from intentional release to an area where it would constitute a threat to public safety. The cost per animal would likely be greater for additional animals and the risks to the animals from each other would be increased, resulting in the need for more elaborate handling strategies.

A complete description and assessment of "passive" and "active" capture methods that would be necessary to implement the status quo (Alternative 1) is provided in Section V.C.4. of the 1995 Environmental Assessment (NMFS and WDFW 1995).

Passive Capture

The "passive" capture approach involves non-lethal, non-injurious trapping of sea lions on haul-out structures that are used by sea lions. Such captures involve "voluntary" entry by sea lions onto platforms modified into traps. The captures occur primarily on the haul-out cage trap in Shilshole Bay (described in the 1995 EA), but could also occur on other floats, docks or structures, which sea lions are observed to haul-out on, that can be modified to non-lethally trap sea lions. For example, in 1993/94, a dock in Shilshole Marina, which was being used by sea lions as a haul-out, was fenced off to form a trap and two sea lions, both of which had been observed in the Locks area, were successfully captured. Another passive capture mode has involved attempts to capture sea lions using a partially submerged baited trap. Such a trap was constructed in 1993/94 and designed to be a selective trap which would capture single individuals from the immediate vicinity of the Locks fish ladder. The advantage of this trap is

that known fish predators could be targeted and removed. Unfortunately, no sea lions have entered this submerged baited trap in the two years that it has been tested.

There are several drawbacks to the passive capture approach. The greatest drawback is that passive capture is totally dependent on individual animal behavior in hauling-out on a trap or site that can be modified for trapping. This passive trapping approach also is not selective and could involve sea lions that are merely moving through the area and are not involved in the conflict at the Locks (as noted above, float traps cannot be placed in the Locks area without possibly exacerbating the problem). Based on prior capture efforts it is anticipated that some of the "predatory" sea lions would not avail themselves to capture by this method. Some animals may be wary of hauling-out on the trap while others, which have been exposed to previous capture attempts, may become trap-shy (avoid hauling on trap). Nonetheless, experience with the passive capture technique indicates that it involves the least possible risk to the animals and to capture personnel. Some level of risk still exists, however, since the animals might behave unpredictably. Risk to personnel must be considered, since the method sometimes requires close handling of the animals inside the trap during the transfer process.

Active Capture

"Active" capture involves the use of entangling or encircling nets, use of drugs, and use of other techniques to selectively capture "predatory" sea lions in the water. Entangling nets could be set in the spillway area or used in combination with sedative darts and/or vessels to encircle or force sea lions into the net. Entangling nets were used in an attempt to capture sea lions during the 1986/87 steelhead season, but no sea lions were captured

Removal of sea lions captured in a tangle net would likely require the use of darting and drugging the sea lion to immobilize it so that it can be safely removed from the net. An alternate approach is to dart the animals with drugs to slow it down before encircling it with the tangle net. Because techniques have not been developed to tranquilize sea lions in the water, there is a possibility of mortality to darted animals from drowning or complications from drugging. Mortality is also possible without using drugs if the animal becomes stressed or severely entangled and drowns before it can be raised out of the water. Drugs were used previously on captured sea lions during the early phases of the 1988/89 capture and transfer program under the advice of consulting veterinarians on an ACC. Two of four sea lions, which were chemically immobilized during the 1988/89 program, died during recovery from anesthesia and drug use was suspended. Histological examination of tissues taken during necropsy of the two animals which died indicated that both

animals had experienced chronic stress as the lymphoid tissues of the spleen were exhausted. The fact that these animals died as a result of complications which were probably attributable to prior stress could not be anticipated during external examination prior to administering the anesthetic. Darting animals in the water would involve the additional risk of animals aspirating water, as well as risks associated with estimating dosages based on observed size of the free swimming animal.

The environmental consequences of this alternative, similar to the other alternatives, involve primarily the California sea lions that frequent the Ballard Locks area and the winter steelhead that migrate through the Locks. The proposed action and the alternatives will have no effect on the physical characteristics of the geographic area nor will it cause the loss or destruction of significant scientific, cultural or historic resources. The non-lethal deterrence measures that are part of the proposed action and alternatives, as described herein, were determined to have no significant impact on the human environment in the 1995 EA (NMFS and WDFW 1995).

V.B. Alternative 2 - Implement Modified Conditions for Lethal Removal as Recommended by the Task Force

This alternative is to implement the recommendations of the Pinniped-Fishery Interaction Task Force to modify the conditions for the lethal removal of sea lions under the Letter of Authorization. This alternative would allow a) the capture and placement in permanent captivity or lethal removal of sea lions which have been observed killing steelhead in the Lake Washington Ship Canal before June 1, 1995 and are encountered in the area of Puget Sound between Everett, Washington and Shilshole Bay including the Lake Washington Ship Canal; and b) the capture and temporary holding, for the duration of the steelhead run, of sea lions which have been observed killing salmon or steelhead after October 1, 1995 (lethal removal of these sea lions would be authorized if captive holding funding is unavailable). The lethal removal "trigger" based on predation rate in relation to available fish would be eliminated under this alternative. The Task Force also recommended that the State non-lethally capture and remove sea lions which are observed foraging in the inner bay for three or more days but which have not been observed killing a fish.

A comparison of the definition of "predatory" sea lions under each of the four alternatives is provided in Section V.C.

Under this alternative, the State would be required to place "predatory" sea lions in captivity on a permanent or temporary basis prior to implementing lethal removal. The Task Force recommended that the past predatory sea lions (which have been observed killing steelhead in the Lake Washington Ship Canal

before June 1, 1995), because of their known behavior to forage and kill steelhead in the Locks area in spite of deterrence efforts, should be captured and removed permanently either to a permanent holding facility or lethally removed, rather than released only to come back again. This recommendation, in effect, would allow immediate lethal removal of sea lions because, to our knowledge, there are no facilities interested in obtaining these sea lions for permanent holding. In May 1995, NMFS distributed a letter to all marine mammal public display permit holders and other facilities in an attempt to locate a facility that would be willing to obtain sea lion #17 (the animal held in captivity in 1995), and no facilities responded on having available space or any interest in assuming permanent captive holding of animal #17 or any other adult male California sea lion. Most display facilities will only take-in young animals from the wild that can be trained and easily adapt to captivity; however, since there are many captive born sea lions available, facilities do not need to acquire sea lions from the wild. Further, most of the trained sea lions in facilities are female sea lions because they grow to about 200 pounds (in contrast to over 1,000 pounds for males) and do not have the aggressive tendencies of mature male sea lions. Mature male sea lions are difficult to handle during their cyclic increase in hormones (during time of breeding season, in spite of being in captivity) when they tend to be overly aggressive and difficult to handle.

Under this alternative, the capture and temporary holding, for the duration of the steelhead run, would be required for sea lions which have been observed killing salmon or steelhead after October 1, 1995, and lethal removal of these sea lions would be authorized only if captive holding funding is unavailable. However, as described in Alternative 1 (Section V.A.), temporary captive holding is not a prudent alternative for eliminating the predation problem at the Locks.

The Task Force recommendation to undertake lethal removal under modified conditions was based on concerns that Lake Washington wild steelhead population is severely depressed for a number of reasons, one of which is the vulnerability of returning spawners to predation by California sea lions at the Locks. To stop significant negative impacts on the steelhead population, the Task Force recommended that any individually identifiable sea lion that has been observed killing steelhead in previous years should be permanently removed (either to permanent captivity or lethally) if observed in Puget Sound between Everett and Shilshole Bay. This approach may result in sea lions being lethally removed without regard to whether they continue to be a threat to the steelhead run (i.e., continue to forage at the Locks during the steelhead run). At least one sea lion which preyed on steelhead at the Locks in the past has not been observed at the Locks since the installation of the acoustic barrier in January 1994 (see sighting records for sea lion #32 in Appendix A) and therefore may not be having a significant

negative impact on the winter steelhead unless it re-appears at the Locks. The primary area of concern for significant negative impacts on steelhead is the area where sea lion foraging has had its greatest impact on returning Lake Washington winter steelhead in the Lake Washington Ship Canal and inner bay adjacent to the fishway. This alternative would not limit lethal removal to a last resort for sea lions which cannot be deterred by non-lethal means, such as the acoustic barrier, and have developed a successful foraging strategy on steelhead and returned to forage at the Locks during the time when wild steelhead may be present (i.e., January 1 through May 31). However, since it is possible that a "predatory" sea lion will kill steelhead at the time of first observation at the Locks, this alternative is more risk averse than the other alternatives in protecting the steelhead run from avoidable predation.

This alternative expands the definition of "predatory" sea lions to include sea lions that have been observed preying on salmon as well as steelhead after October 1, 1995. This is based on the observations that predation on salmon late in the year at the Locks is likely a precursor and comparable foraging behavior to preying effectively on steelhead at the Locks. A more significant point is that predation on salmonids in the inner bay during acoustic deterrence represents a behavioral pattern which when exhibited during the steelhead run constitutes a high risk to the recovery of the steelhead run.

The Task Force also recommended that the Letter of Authorization be modified such that any identifiable sea lion that has been observed engaging in foraging behavior, as interpreted by trained observers on three or more days in the inner bay areas 1-4, may be removed, but only non-lethally if they have not been observed killing a steelhead or salmon. Also, if monies have not been allocated for non-lethal holding, then the animal could be relocated, but not lethally removed. Since the existing Letter of Authorization, as well as Section 109 of the MMPA, already allow the non-lethal removal of sea lions observed foraging at the Locks (regardless of the amount of time spent there), no action is necessary on this recommendation.

The potential for lethal removal of sea lions under this alternative is similar to the other alternatives in that lethal removal is unlikely to involve more than 5-10 predatory sea lions. Further, as an additional "safety valve" to prevent large numbers of lethal removals, the Letter of Authorization stipulates that if 15 sea lions are lethally removed, the Task Force would be reconvened to review and evaluate the effectiveness of the measures implemented.

This alternative would involve capture of "predatory" sea lions using "passive" or "active" capture techniques, which are described in Section V.A.

The environmental consequences of this alternative, similar to the other alternatives, involve primarily the California sea lions that frequent the Ballard Locks area and the winter steelhead that migrate through the Locks. The proposed action and the alternatives will have no effect on the physical characteristics of the geographic area nor will it cause the loss or destruction of significant scientific, cultural or historic resources. The non-lethal deterrence measures that are part of the proposed action and alternatives, as described herein, were determined to have no significant impact on the human environment in the 1995 EA (NMFS and WDFW 1995).

V.C. Alternative 3 - Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Steelhead at Locks (Proposed Action)

The proposed action is to modify the conditions under which lethal removal of individually identified "predatory" sea lions will be implemented. Under the proposed action, non-lethal deterrence including an acoustic barrier would be used to reduce the presence of sea lions in the primary predation area of the inner bay. Sea lions that enter and remain in the ensonified zone would be subject to additional non-lethal measures such as use of underwater firecrackers. Individually identified "predatory" sea lions that have been observed preying on returning steelhead in the inner bay area of the Lake Washington Ship Canal since implementation of the acoustic deterrence program in 1994 could be lethally removed if they are observed foraging in the inner bay area during the winter steelhead run (January 1 to May 31).

The proposed action would allow lethal removal of "predatory" sea lions which have returned to the Locks to forage during the steelhead run and are not deterred by the acoustic barrier. The proposed action eliminates the lethal removal "trigger" which defines when or if lethal removal may commence or must be discontinued, based on a kill rate comparison with available fish as counted passing through the fishway. The proposed action relies instead on observations of past and present foraging behavior of individually identifiable sea lions at the Locks that will continue to negatively impact the steelhead population if not stopped. Waiting for predation to occur (as was required under the "trigger") allows "predatory" sea lions to continue foraging at the fishway thereby disrupting steelhead migration and increasing steelhead vulnerability to predation and the risk for additional losses to the steelhead run. In 1995, after the lethal removal "trigger" was reached on January 24, one sea lion still took three steelhead on February 8, and continued to forage until May 19 when it first became subject to capture. The three steelhead represented 60% of the fish counted on February 8 (3 killed and 2 through the fishway) and 42% of the fish counted that week (3 killed and 4 counted through the fishway).

A comparison of the definition of "predatory" sea lions under each of the four alternatives indicates that the proposed action (this alternative) is more restrictive than the other alternatives in defining the sea lions that are "predatory." Actions taken with "predatory" sea lions also differ between alternatives 1 to 3. The proposed action is more restrictive than the status quo (Alternative 1) and the Task Force recommendation (Alternative 2) in that the proposed action not only requires that an identifiable sea lion be observed killing a steelhead, but also requires that the sea lion must have been observed penetrating the acoustic barrier and have foraged in the ensonified zone, and that the sea lion must have been observed in the inner bay area during the current steelhead run. Further, the proposed action is more restrictive than the Task Force recommendation (Alternative 2) and Alternative 4 in that the definition of "predatory" in the proposed action does not include observed predation on salmon, but only steelhead, in the inner bay area. In the context of area involved, the Task Force recommendation (Alternative 2) is the least restrictive in that it would allow for lethal removal of "predatory" sea lions when first observed anywhere between Everett, WA and Shilshole Bay; the proposed action is much more restrictive in that it requires that the sea lion be observed foraging in the inner bay during the current season before it can become a candidate for lethal removal. The Task Force recommendation (Alternative 2) does distinguish between past predators on steelhead at the Locks (prior to June 1, 1995) and newly observed steelhead predators (after October 1, 1995) with permanent holding or lethal removal for past predators and temporary holding (until end of season) or lethal removal, if funding for holding is not available, for newly identified "predatory" sea lions. The status quo (Alternative 1) does not distinguish between "old" and "new" predators, but does require that all "predatory" sea lions be placed in temporary captivity and lethal removal be considered only if temporary captivity is not feasible or practical. The proposed action also does not distinguish between 'Old" and "new" predators, but rather allows for lethal removal of sea lions that meet all three criteria of the "predatory" definition since such animals, which cannot be deterred from the Locks area regardless of whether they are "new" or "old" predators, are having a significant negative impact on the steelhead run.

The proposed action is necessary to allow the State to respond to the presence of foraging sea lions in the inner bay as quickly as possible to minimize predation on returning steelhead by known "predatory" animals, and thereby stopping significant negative impacts on the status and recovery of the winter steelhead population. The proposed action would allow lethal removal of sea lions which have taken returning steelhead at the Locks and which have returned to forage within the ensonified zone during the steelhead run. The authorization to only lethally remove individually identifiable animals that have been observed killing returning steelhead and are foraging in the inner bay during the

steelhead season would minimize the number of animals affected by this action and further ensure that other non-involved sea lions in Puget Sound are not impacted. This action will stop significant negative impacts on the status and recovery of the winter steelhead population. The proposed action would include use of active capture (previously assessed in the 1995 EA), but only for "predatory" sea lions that do not subject themselves to trapping.

Information presented in this EA and other reports on the sea lion-steelhead conflict at the Locks, indicate that "predatory" sea lions are having a significant negative impact on the recovery of the winter steelhead population. These impacts by "predatory" sea lions on the steelhead run can be either direct or indirect as described below.

Direct impacts on winter steelhead population are caused by a "predatory" sea lion preying on a returning adult steelhead as it attempts to migrate into the freshwater environment to spawn. Observations of predatory sea lions at the Locks in previous years demonstrate their potential for significant impact on this small fish run. In 1985/86, one sea lion averaged 12 steelhead killed over 8 hours during a one week sampling period (Gearin et al. 1986). This one animal accounted for at least 60% of all the observed fish kills during this time period. In 1986/87, at least 11 individual sea lions were identified at the Ballard Locks, but 3 animals in particular accounted for 98% of all observed fish kills by identifiable animals (Gearin et al. 1987). Individual predation rates of these 3 sea lions ranged from 0.61 to 0.91 fish killed per hour during a sampling period in 1986/87. These data indicate the potential magnitude of sea lion predation by only a few sea lions if these predation rates were extrapolated out for a full season. Therefore, in view of the small size of the steelhead run in 1995/96, these "predatory" sea lions are having a significant negative impact on the status and recovery of the steelhead population if they are not removed to prevent them from preying on returning steelhead at the Locks.

Indirect impacts on the winter steelhead population are caused by a "predatory" sea lion foraging in the inner bay area. Foraging behavior of sea lions at the Ballard Locks was defined and described in Gearin et al. (1986). The behavior was characterized by continuous movement consisting of a series of shallow dives averaging 1-3 minutes in duration, followed by a short 10-60 second rest period at the surface. It was estimated that sea lions at the Locks spent at least 95% of their time actively foraging. Indirect impacts result when a "predatory" sea lion 1) forages in the fishway area thereby preventing steelhead from accessing the fish ladder and thereby increasing the timeframe that migrating steelhead are in the marine environment and vulnerable to predation, 2) forages in the spillway area and disperses steelhead out of the ensonified zone protected by the acoustic devices, 3) forages in the Locks area

and disperses migrating steelhead back downstream increasing their vulnerability to predation both in area and time, 4) forages in the Locks area and disperses migrating steelhead causing delays in migration and increased potential for straying into other systems (thereby further reducing the numbers of spawners that return), and 5) forages in the ensonified zone and serves as a "model" to attract other sea lions to the immediate Locks area (i.e., the predatory sea lions serve as a stimulus to new sea lions to overcome acoustic deterrence).

Newly identified "predatory" sea lions will include those that are observed killing returning steelhead in the inner bay area (upstream from the railroad bridge) and that have penetrated the acoustic barrier and foraged in the ensonified zone after the date of issuance of the Letter of Authorization. These animals will have both direct and indirect impacts on the steelhead run as described above. Some of the newly identified "predatory" sea lions may actually be sea lions that have foraged repeatedly and successfully at the Locks, but were not previously individually identifiable (i.e., not branded), or were involved in steelhead predation where the observer could not determine the identification of the involved sea lion. Therefore, under the proposed action, state officials would be required to provide the data used to determine that a new sea lion meets the "predatory" definition to, and obtain concurrence of, the NMFS Northwest Regional Director prior to lethal removal of these sea lions.

Past efforts have proven that non-lethal deterrence efforts alone will not be totally effective and that lethal removal must also be implemented as a last resort. The acoustic barrier is intended to preclude naive animals from effectively preying on steelhead at this site, thereby reducing the number of sea lions that might become candidates for lethal removal because they might forage and kill steelhead at this location. Data collected during the fall coho run indicates that the acoustic barrier will minimize the possibility of replacement of "predatory" sea lions with new entrants. Past data indicates that although many sea lions may transit the Shilshole Bay area, only a few of these routinely enter the Locks area; and of these, an even smaller number remain to forage in the presence of the acoustic barrier and are responsible for most of the predation. This information is supported by new information from marking programs which have been ongoing since 1989. Approximately 250 sea lions have now been marked at Shilshole Bay. This represents about 20% of the peak number of sea lions counted at Everett in 1995 and over two times the peak number of sea lions counted at Shilshole Bay last year. In spite of the large number of marked sea lions at Shilshole Bay, only seven marked animals were observed at the Locks during the 1994/95 steelhead run.

Action to eliminate sea lion predation losses on steelhead by identifiable individual California sea lions at the Locks facility is necessary because the fundamental unit of replacement

or recruitment for anadromous salmonids is the local population (Rich 1939, Ricker 1972). The importance of the Lake Washington wild winter-run as a local population and component of the larger steelhead population of Puget Sound, should not be understated. An adequate number of individuals for each local reproductive population is needed to ensure persistence of the many reproductive units that make up a fish stock (NRC 1995). The numbers of returning Lake Washington steelhead have now declined to levels below the 150 fish threshold indicated by the Biological Requirements Work Group (1994) as critical for the successful recovery of small salmonid populations. Repeated spawning returns of less than 150 fish suggests that the continued survival of the population appears to be highly uncertain and therefore it is necessary to eliminate avoidable losses to the maximum extent possible.

The environmental consequences of the proposed action, similar to the other alternatives, involve primarily the California sea lions that frequent the Ballard Locks area and the winter steelhead that migrate through the Locks. The proposed action will have no effect on the physical characteristics of the geographic area nor will it cause the loss or destruction of significant scientific, cultural or historic resources. The non-lethal deterrence measures that are part of the proposed action and alternatives, as described herein, were determined to have no significant impact on the human environment in the 1995 EA (NMFS and WDFW 1995).

The proposed action requires that an individually identifiable sea lion be observed foraging in the primary area of concern in the inner bay during the current year in order to be considered for lethal removal. This action will remove the individually identifiable sea lions that are having a significant negative impact on the status and recovery of the winter steelhead population. Past foraging and predatory behavior by certain sea lions on steelhead at the Locks in spite of intense deterrence efforts provides the basis for removing these sea lions that return to forage at the Locks during the steelhead run. Allowing a sea lion, which has developed the foraging skills to capture free-swimming returning steelhead within the inner bay at the Ballard Locks and has shown by past behavior to be tolerant to non-lethal deterrent measures, to forage in the inner bay during the period from January 1 to May 31 will result in steelhead mortality. The fact that an animal has taken a steelhead previously in the Ship Canal and is observed foraging within the inner bay during the steelhead season indicates that it poses a sufficient threat to returning adult fish to warrant removal. Under the proposed action, after a "predatory" sea lion has been observed to return and forage in the inner bay area during the steelhead run, there is no restriction on where the sea lion may subsequently be lethally removed during the steelhead season. It is recognized that under the proposed action, some steelhead mortality may occur when the "predatory" sea lion first enters

the Locks area or during the timeframe before it can be captured; however, the requirement that predatory sea lions be observed in the inner bay during the steelhead season is intended to focus the use of lethal removal on only those individually identifiable sea lions that repeatedly return to the Locks and cannot be deterred by the available non-lethal means. The proposed action is more restrictive than the Task Force recommendation (Alternative 2) which does not require observation of a previously defined "predatory" sea lion at the Locks during the current steelhead season.

With the conditions applied and dependent on the effectiveness of the acoustic devices, it is unlikely that the proposed action will result in the lethal removal of more than 5 to 10 sea lions. A list of marked sea lions which would meet the criteria for lethal removal if they return to the inner bay between January 1 and May 31 is shown in Table 5. Additional animals which are individually identifiable and are observed killing steelhead at the Locks during the acoustic deterrence efforts may be added to this list. Although Table 5 lists 16 marked sea lions, nine of these animals have not been sighted at the Locks for five years or more, and therefore are unlikely to be candidates for lethal removal. One sea lion (#32), which previously killed a steelhead in the Locks area, has not been observed at Locks since implementation of the acoustic barrier although it has been observed in Shilshole Bay. Therefore, under the proposed action, the sea lions that meet the definition for lethal removal, if they are observed foraging in the Locks area, is limited to three individual sea lions (#'s 17, 41 and 225), and two sea lions (#45 and #87) that will be candidates as soon as they are observed preying on returning steelhead. The State may determine that additional animals meet the definition of "predatory" sea lions during the steelhead season, but would have to obtain the concurrence of NMFS before proceeding with the lethal removal of these additional animals. NMFS would consider all available data before concurring. Further, as an additional "safety valve" to prevent large numbers of lethal removals, the Letter of Authorization will stipulate that if 15 sea lions are lethally removed, then lethal removal would cease until the Task Force is reconvened to review and evaluate the effectiveness of the measures implemented.

The Muckleshoot Indian tribe, in a February 1, 1996 letter to NMFS, has requested that any sea lion captured for lethal removal be provided to the tribe so that the tribe may use the sea lion for ceremonial and subsistence purposes in the exercise of their treaty rights. The letter included a copy of the Muckleshoot Indian Tribe annual hunting regulations #96-01 for the hunting of marine mammals. The tribe indicated in their letter than any California sea lion provided to the tribe under the State's Letter of Authorization would be deducted from the tribal quota for California sea lions. Such use would avert the need by the tribe to remove additional sea lions for subsistence purposes

thereby making these lethal takes inconsequential (i.e., the same number of sea lions would have been taken for subsistence by the tribe).

TABLE 5. Marked California sea lions that have been observed foraging at the Locks and may be lethally removed under the proposed action if the sea lion is observed foraging in the inner bay area during the current steelhead run (January 1 - May 31).

Sea Lion ID#	Adult Steelhead Predator Yes/No	Foraged in Ensonified Zone Yes/No	Last Seen In Inner Bay
1	Yes	No	Feb. 1989
6	Yes	No	Feb. 1990
17	Yes	Yes	Jan. 1996
19	Yes	No	Apr. 1990
23	Yes	No	Feb. 1990
25	Yes	No	Nov. 1990
30	Yes	No	Apr. 1990
32	Yes	No	Nov. 1993
34	Yes	No	Apr. 1989
38	Yes	No	Apr. 1989
41	Yes	Yes	Feb. 1995
42	Yes	No	Apr. 1991
45	?*	Yes	Jan. 1996
87	?*	Yes	Jan. 1996
225	Yes	Yes	Jan. 1996

* - These two sea lions have not been confirmed to have killed returning steelhead, and will be candidates for lethal removal as soon as a steelhead predation is observed.

The proposed action, similar to the other alternatives, could involve capture of "predatory" sea lions using "passive" or "active" capture techniques, which are described in Section V.A. However, in contrast with the status quo (Alternative 1) and the Task Force recommendation (Alternative 2), the proposed action does not require capture for captivity and thereby includes the option of intentional lethal take without capture. In situations where "predatory" sea lions are not using the trap platform to haul-out (e.g., they haul-out on bell buoys), the proposed action would allow intentional lethal take using euthanasia protocols developed by the Animal Care Committee (ACC). This approach accounts for the possibility described herein of sea lions being "uncatchable" and allows necessary additional flexibility, when necessary, to take action to lethally remove "predatory" sea lions.

Non-lethal Deterrence Measures

During the 1994/95 steelhead season, an array of acoustic deterrence devices were installed and operated as an "acoustic barrier" for virtually the entire season. Mean daily sea lion abundance in 1994/95 was lower than in 1993/94 which in turn was at least an order of magnitude below levels seen in earlier years (Foley 1996). It is not yet clear whether the reduction in sea lion abundance is the primary result of low steelhead abundance or the effects of acoustic barrier operation. However, tests conducted during the fall coho run indicate that the acoustic barrier is a useful tool for reducing sea lion presence and the foraging efficiency of sea lions when salmonids are present. Data collected during the steelhead run, the early summer smolt outmigration, and the fall coho test showed that certain sea lions will penetrate the barrier and some animals will forage within the ensonified zone. In comparing the behavior of marked sea lions which have been observed killing fish in the inner bay, such as sea lion #87, with other unidentified animals, the acoustic barrier appears to have a beneficial deterrent effect. During the fall coho test, overall sea lion abundance in the inner bay was reduced when the acoustics were turned on, and attendance by unidentified animals dropped from nearly 70% of the time spent by sea lions in the inner bay, with the acoustics off, to less than 10% when the acoustics were turned on. Foraging efficiency also appeared to be affected. With the acoustics turned off, nearly 20% of the fish kills observed were by unidentified animals. With the acoustics turned on, all of the salmon kills observed were made by #87. Sea lion #87 was responsible for the majority of the fish kills whether or not the acoustic barrier was activated and the acoustic devices did not appear to change the distribution of kills made by this animal. It is important to recognize that unidentified sea lions includes unmarked individuals as well as marked animals whose marks were not observed. It is therefore apparent that certain sea lions, several of which have now been marked, are capable of having a dramatic impact on steelhead mortality if allowed to forage in the inner bay, while others do not remain in the inner bay when the acoustic devices are operating.

The maximum distance at which the acoustic barrier can be detected varies with background noise but is consistently less than two kilometers based on observations made in the Ship Canal and Shilshole Bay (Bain 1996). The 120 dB contour occurs within one kilometer of the barrier. The finger piers cast "shadows" resulting in lower sound levels than would be expected from distance alone (Norberg and Bain 1994). Additional acoustic devices delivering alternate frequencies could be used to expand the area of intense ensonification to areas which are currently shadowed by the piers. Measurements conducted in 1995 indicate that sound pressure levels on the order of 165 $dB_{(RMS)}$ to 190 $dB_{(RMS)}$ are generally maintained within the "ensonified zone" (observation zones 1-4) near the dam under low spill conditions. The increase in the number of transducers did not increase the overall sound pressure levels to which sea lions would be exposed

within the ensonified zone. Therefore, as previously concluded in the 1995 EA, the acoustic barrier should have no effect on sea lions beyond the desired avoidance behavior.

The measurements also showed that the sound produced by the acoustic barrier faded to the ambient levels of Puget Sound within two kilometers of the barrier. Two kilometers falls roughly mid-way between the red and green channel marker buoys and the bell buoy marking the entrance to the Lake Washington Ship Canal. The most commonly observed marine mammals in this area are California sea lions and observations indicate that local abundance of this species has not been negatively affected by the operation of the acoustic barrier. California sea lions have been observed hauled-out, rafting and foraging in the area. Marine mammals, other than California sea lions, are not common in the Ship Canal. However, harbor seals are now appearing more commonly in the inner bay area and several seals have been sighted within the ensonified zone in 1994 and 1995. Although harbor seals at the Locks represent some degree of threat to returning steelhead, both by direct predation and by impeding fish passage while foraging in front of and inside the fish ladder (one was observed taking a free swimming chum salmon in the inner bay in 1995), they have not been observed to be as effective at capturing adult steelhead as sea lions, and State (WDFW) and federal (NMFS) resource managers may use non-lethal means to deter or remove harbor seals from the Locks area as authorized under Section 109(h) of the MMPA. Killer whales have been sighted in Shilshole Bay transiting the area beyond the bell buoy. In addition, northern fur seals and Steller sea lions have been seen on the floating trap which is located just beyond two kilometers from the acoustic barrier in Shilshole Bay. It is not known whether these animals were close enough to detect the sound emanating from the acoustic array, but their sightability from shore would indicate that they have not been excluded from the area. Seabirds have been observed foraging in the "ensonified" area (caused by acoustic array) at the Locks and no noticeable change in seabird behavior has been observed relative to the operation of the acoustic devices. The acoustic devices have been tested on fish and caused no reaction. For these reasons the operation of the acoustic barrier at current sound pressure levels and frequencies at or above those currently in use should have no effect on other marine mammals, seabirds or fish.

V.D. Alternative 4 - Implement Modified Conditions for Lethal Removal Based on Foraging Behavior and Predation on Returning Salmonids at Locks

Under this alternative, the definition of "predatory" is modified to include sea lions observed to prey on adult salmon at the Locks because observations indicate that certain sea lions that are known to have preyed on salmon at the Locks will also prey on steelhead when they are available at the Locks. The new data

collected in 1995 (see Section IV.J.) indicates that several of the marked animals (#45, #87 and #225) that were observed foraging, but not necessarily killing steelhead, in the inner bay during the steelhead run in 1995 were also present during other times of the year and successfully preyed on salmon when the acoustic devices were operating. These sea lions have returned to forage at the Locks during the steelhead run assumably because they have effectively foraged on migrating salmonids at this site. For example, sea lion #87 was the most frequently identified sea lion observed foraging at the Locks during the steelhead run in 1995, but was not observed to have killed a steelhead. Nonetheless, sea lion #87 repeatedly returned to the Locks area to forage, in spite of the acoustic deterrence, and was ultimately observed killing sockeye salmon in the inner bay area when sockeye began migrating through the area. Sea lion #87 returned in the fall and was the principal predator on coho salmon in the ensonified zone at the Locks. This animal has again been observed foraging at the Locks during the 1995/96 steelhead run and will kill a steelhead when one is available. The behavior of migrating salmon, which are seeking the entrance to the fishway, and migrating steelhead are similar and sea lion predation effectiveness on one migrating salmonid is unlikely to be different than another. It is very possible that #87 either has killed a steelhead but was not observed or identified, and/or killed steelhead at the Locks prior to 1995 when it was branded (i.e., it was one of the unmarked predators in prior years). Therefore, sea lion #87, which has been observed to kill salmon but not steelhead at the Locks, is as much of a threat to the steelhead population as is a sea lion that has been observed to kill a steelhead. The same rationale applies to sea lion #45, which also has been observed killing salmon, but not steelhead. Although sea lion #45 was seen and identified on multiple occasions during the steelhead run, the first fish kill which was positively attributed to it in 1995 was an adult sockeye salmon taken in the ensonified zone in June. Sea lion #45 returned to the Ballard Locks in November 1995 and was observed preying on coho salmon. In December 1995, sea lion #45 was observed preying on 3 salmonids which were probably chum salmon at the Ballard Locks. Sea lion #225, which was observed killing steelhead in 1995, exhibited the same foraging behavior as #87 and #45, and was also observed killing sockeye salmon at the Locks in June and foraging at the Locks during the coho run (but was not observed killing a coho). These observations make it obvious that certain sea lions have learned to efficiently forage on salmonids at the Locks, in spite of acoustic deterrence, and that these sea lions will kill steelhead at the Locks if steelhead are available thereby posing a threat to the viability of the steelhead population.

A comparison of the definition of "predatory" sea lions under each of the four alternatives is provided in Section V.C.

In addition to the observations described above on identifiable

sea lions as basis for including salmon predation in the definition of predatory, there are a number of other factors that affect whether steelhead predation is actually observed and attributed to a marked sea lion and this uncertainty was taken into account in developing a "predatory" definition that ensures steelhead will be protected from predation. Although California sea lions are relatively easy to see at the Locks, they are not readily identified each time they surface; marked animals may surface in a manner which obscures the identifying marks. Glare, chop, or rain also may interfere with observations. Multiple animals may be present in the inner bay at once, thereby confounding the observers ability to attribute an observed kill to an individually identified animal. In these instances, observed kills are noted as kills by unidentified animals, when in fact the sea lion may have been marked. In 1994 for example, all of the observed steelhead kills could not be attributed to a known individual, but some or all of these may have been taken by marked animals especially sea lion #17 which was foraging at the Locks frequently in 1994. Also, not all predation events are observed. Although the current methodology estimates predation levels by extrapolating observed kill rates over unobserved time frames, some kills can and probably do occur during observation periods. Sea lions move freely between the spillway area, the lock door area and the area below the railroad bridge while submerged, and the observer does occasionally lose sight of an animal for short periods when the animal submerges and relocates to a different area of the inner bay while foraging. Also, an observer may also be focused on one animal in one location such as the spillway area while another sea lion is killing a steelhead in the large locks (unobserved). Further, the observers responsibilities include checking the fish counter and viewing chamber periodically and would not see a steelhead kill during this period of time. It should be noted that the number of observed fish kills reported represents a minimum count of actual fish mortality. Nonetheless, the predation estimation methodology is conservative and assumes that all fish mortalities are observed during the monitoring period, and therefore kill estimates likely under-represent the actual impact of predation on the steelhead run to some degree.

In summary, salmon predation is included in the "predatory" definition under this alternative because the new data collected in 1995 demonstrate that certain sea lions will forage at the Locks when salmonids are available in spite of the acoustic deterrence and can cause both direct and indirect impacts on the steelhead population. Of the 200+ marked sea lions in Shilshole Bay in 1995, only those marked sea lions that have been observed at the Locks in past years during the steelhead run were also involved in predation on adult salmon. Only sea lion #'s 17, 41, 45, 87 and 225 have been observed preying on returning salmonids during operation of the acoustic device, and all of these sea lions have been observed actively foraging in the inner bay area during the steelhead run. Therefore, based on the repeated

foraging behavior of these few sea lions that have preyed successfully on returning salmonids (steelhead or salmon) at the Locks in the presence of the acoustic deterrents, it is expected that they will continue to have a significant negative impact on the recovery of the steelhead population if they are not removed and prevented from foraging at the Locks during the steelhead run.

This alternative is the same as Alternative 3 in capture and lethal removal considerations (see Section V.C.).

The environmental consequences of this alternative, similar to the proposed action, involve primarily the California sea lions that frequent the Ballard Locks area and the winter steelhead that migrate through the Locks. This alternative will have no effect on the physical characteristics of the geographic area nor will it cause the loss or destruction of significant scientific, cultural or historic resources. The non-lethal deterrence measures that are part of the proposed action and alternatives, as described herein, were determined to have no significant impact on the human environment in the 1995 EA (NMFS and WDFW 1995).

VI. CONSIDERATIONS UNDER SECTION 120(d) OF THE MARINE MAMMAL PROTECTION ACT.

In accordance with Section 120(d) of the MMPA, in considering whether an application should be approved or denied, the Pinniped-Fishery Interaction Task Force and the Secretary must consider:

1) population trends, feeding habits, the location of the pinniped interaction, how and when the interaction occurs, and how many individual pinnipeds are involved;

2) past efforts to non-lethally deter such pinnipeds, and whether the applicant has demonstrated that no feasible and prudent alternatives exist and that the applicant has taken all reasonable non-lethal steps without success;

3) the extent to which such pinnipeds are causing undue injury or impact to, or imbalance with, other species in the ecosystem, including fish populations; and

4) the extent to which such pinnipeds are exhibiting behavior that presents an ongoing threat to public safety.

The information that was considered pertinent to each of the points was previously described in the 1995 Environmental Assessment (NMFS and WDFW 1995). New information resulting from the 1995 activities and additional considerations on modifying the lethal removal conditions are provided below under each item.

VI.A. Consider population trends, feeding habits, the location of the pinniped interaction, how and when the interaction occurs, and how many individual pinnipeds are involved.

The current west coast population of California sea lions is estimated in excess of 200,000 animals with about 161,000 to 181,000 of these in U.S. waters (Barlow et al. 1995). The current stock assessment report for the U.S. population indicates that the population has been increasing at a rate of about 5% annually since 1975. The calculated Potential Biological Removal (PBR), a level of mortality from other than natural causes (i.e., human caused mortality) which can be safely sustained by a marine mammal population without significantly affecting its recovery to optimum sustainable population, for California sea lions (U.S. stock) is 5,052 animals (Barlow et al. 1995). Current estimates of human caused mortality, primarily due to incidental take in commercial fisheries off California was estimated to average 2,446 animals per year for the years 1991 to 1993. However, preliminary mortality estimates for the first three quarters of 1994 indicated that a large reduction in the mortality rate had taken place and that mortality of California sea lions in commercial fisheries may have been less than 10% of PBR in 1994 due to the closure of California coastal set-net fisheries (Barlow et al. 1995). The 5 to 10 sea lions that might be lethally removed at the Locks is well within the PBR. There is no information to indicate that human caused mortality for sea lions is approaching PBR or that human caused mortality will have any significant effect on the recovery of the population. Because the population of the U.S. stock of California sea lions is currently growing and no density dependent signal has been identified for the series of counts which comprise the available data, it is not possible to determine the stocks status relative to its optimum sustainable population level, however, the removal of a small number of surplus male animals will have no effect on the net productivity of the population. Three of the five sea lions that may meet the definition of "predatory" (#45, #87, #225) were observed on the breeding Islands in 1995, and none of them were holding breeding territories. Sea lion #17 was not visually sighted on San Nicolas Island, but the satellite fixes indicated that this animal also was not territorial. Sea lion #17 arrived on San Nicolas on June 26 and spent approximately 2 days onshore before going to sea for 1 day. The animals pattern continued through July in which he spent 1-4 days onshore and 1-2 days at sea. Territorial males will defend territories for 2-3 weeks without going to sea to feed. It is unlikely therefore, that animal 17 held a territory during the 1995 breeding season.

The 1986 estimate of sea lion peak abundance in Puget Sound (1,000) was exceeded in 1995. Counts in Everett surpassed 1,100 and the overall Puget Sound numbers were higher than 1,200. Nevertheless, only a relatively small proportion of these animals enter the Locks area. This is supported by new information from

marking programs. Approximately 255 sea lions have now been marked at Shilshole Bay. This represents about 20% of the peak number of sea lions counted at Everett in 1995 and over two times the peak number of sea lions counted at Shilshole Bay last year. In spite of the large number of tagged animals, only seven marked animals were identified at the Locks during the 1994/95 steelhead run.

California sea lions are opportunistic feeders preying on a wide variety of fish and squid. Some of the more common prey within the breeding range in California are Pacific whiting, anchovy, squid, and rockfish (NMFS 1992). North of the breeding range, the diet shifts to those species which are locally and seasonally abundant. Important prey in Washington are Pacific whiting, herring, spiny dogfish, codfish and salmonids (Gearin et al. 1986, Gearin et al. 1988). California sea lions feed on steelhead, coho, sockeye, chum and chinook salmon throughout Washington, both on free swimming fish and from gillnets and hook-and-line gear. The seasonal occurrence of California sea lions in Puget Sound coincides with the timing of winter steelhead spawning migration run. Although sea lions have been observed preying on steelhead in other areas of Puget Sound (e.g., Duamish River, Nisqually River), the significant negative impacts of such predation on steelhead has been documented only on the Lake Washington winter steelhead population. No estimates are available on the total biomass of salmonids consumed by California sea lions on a state-wide basis.

As previously indicated in his EA, much of the steelhead predation at the Locks is attributable to a small number of sea lions that return to the Locks each year and prey on steelhead. Steelhead predation has been observed throughout the Ship Canal from the Locks facility downstream to the Ship Canal entrance at Shilshole Bay. The principal area of predation has been the inner bay area in front of the fishway; however, no steelhead predation has been observed in zones 1-4 when the acoustic barrier has been in operation during the past two years. Tagging studies conducted at Shilshole Bay in 1994/95 showed that a large number of sea lions transit the area and move between Shilshole Bay and Everett. A small number of animals enter the inner bay, and only a fraction of these remain to forage when the acoustic barrier is activated.

With the conditions applied and dependent on the effectiveness of the acoustic devices, it is unlikely that the proposed action will result in the lethal removal of more than 5 to 10 sea lions. Under the proposed action, the number of sea lions which have been identified as candidates for lethal removal without additional concurrence from NMFS, is initially limited to three individuals (#17, #41 and #225), and can be applied to sea lion #45 and #87 if they are confirmed killing returning steelhead. The State may determine that additional animals meet the definition of "predatory" sea lions and must obtain the

concurrence of NMFS before proceeding with the lethal removal of these additional animals. If 15 sea lions are lethally removed, lethal taking would cease until the Task Force is reconvened to review and evaluate the effectiveness of the measures implemented.

VI.B. Consider past efforts to non-lethally deter such pinnipeds, and whether the applicant has demonstrated that no feasible and prudent alternatives exist and that the applicant has taken all reasonable non-lethal steps without success.

NMFS and WDFW have undertaken a number of non-lethal predation reduction efforts since the 1985/86 season. These non-lethal efforts have included harassment using underwater firecrackers, boat chasing and hazing, sonic repulsion devices, taste aversion conditioning, tactile harassment with rubber-tipped arrows, experimental barrier nets, acoustic barriers, and trapping and relocation of sea lions to the outer coast of Washington and to their breeding grounds off southern California. None of these non-lethal methods have been totally successful in eliminating the steelhead predation problem at the Locks. Data collected over the past ten years clearly indicates that non-lethal deterrence methods must be combined with permanent removal of certain sea lions in order to be effective in eliminating sea lion foraging at the Locks (e.g., implementation of acoustic barrier with lethal removal of only those sea lions that repeatedly penetrate the barrier and forage in the ensonified zone).

In addition, a number of efforts to increase wild steelhead spawning escapement have occurred through restrictions and closures of the sport fisheries; restrictions and closures of treaty Indian fisheries; modified flow patterns at the spillway to improve passage into the fish ladder; collection and spawning of broodstock at the fishway and rearing their progeny to fry for planting in the upper Cedar River; and, collection of adult steelhead below Landsburg Dam and transport above the dam (upper Cedar River) for spawning in otherwise unavailable habitat. A summary of ongoing efforts to recover the winter steelhead population are described in Section IV.L. of this EA.

The concept of a physical barrier is not feasible for the protection of the 1995/96 steelhead run because previous testing did not show the concept to be effective. An experimental barrier net, tested in 1987/88, was found to be ineffective in reducing the overall predation rate. Sea lion predation shifted to areas downstream of the refuge created by the physical barrier (Pfeifer et al. 1989). If results of ongoing investigations did lead to a conceptual design of an operable barrier, the actual structure would not likely to be in place for many years. In the absence of a functional physical barrier, the acoustic devices

deployed at the Locks serve as an acoustic barrier to reduce the presence of sea lions in the area. Regarding the installation of steelhead refuge, there are no observations which indicate that steelhead use the existing available cover (piers, pilings, etc.) as a means of escaping predation. Testing the refuge concept would be necessary in a controlled environment to ensure that such a structure would not result in impaired fish passage or increased predation vulnerability. For example, during the 1987 barrier test, steelhead occasionally delayed passing through the barrier to relative safety and sea lions were observed to kill returning steelhead at the face of the barrier.

During the 1994/95 steelhead run, non-lethal efforts were again used. These efforts included implementation of an acoustic barrier, underwater firecrackers and boat hazing. Three sea lions were captured and removed from the area. Sea lion #17 was captured early in the season and placed in captive holding for the duration of the run. Sea lions #87 and #225 were captured late in the season, translocated to the Strait of Juan de Fuca and released. All three of these animals subsequently returned to the Locks area and were observed foraging in the ensonified zone in front of the fish ladder.

Non-lethal alternatives, such as the acoustic barrier, have been shown to have limited success in reducing predation as some animals "learned" to avoid or tolerate the negative stimuli generated. An example is the observations made of sea lion #87 foraging on coho in 1995 (see Section IV.J.). Sea lion #87 continued to forage and kill salmonids in spite of acoustic barrier operation while the presence of other sea lions in the area was significantly reduced. To be effective in reducing predation to the maximum extent practicable, any measure undertaken must effectively remove the predatory sea lions from the foraging area since even a small number of sea lions foraging in the Ship Canal are capable of inflicting substantial losses on the steelhead run.

Past experience has shown that non-lethal deterrence efforts must be combined with other measures in order to be effective in reducing predation. Past efforts by NMFS and WDFW have been unsuccessful in finding a feasible non-lethal approach that is continuously effective in eliminating predation for all animals. Non-lethal deterrence measures appear to be effective on new entrants to the Locks area, but quickly become ineffective if used on naive animals in the presence of the non-responsive "predatory" sea lions that do not react to deterrence. Removal of these "problem" animals therefore enhances the effectiveness of non-lethal measures on other sea lions.

In order to minimize/eliminate predation on wild steelhead, lethal removal is necessary as a last resort for those animals that cannot otherwise be deterred from the area. Current run levels are precariously low, which elevates the importance of

saving as many adults as possible. Because the overall run size is now so reduced, even one sea lion remaining in the primary foraging area could remove an excessive number of returning fish. As described in Section V.A., temporary captive holding does not resolve the problem.

VI.C. Consider the extent to which such pinnipeds are causing undue injury or impact to, or imbalance with, other species in the ecosystem, including fish populations.

At the extreme low levels of returns of Lake Washington winter steelhead expected in 1995/96, all mortality factors, including predation, must be eliminated if possible to assure that an adequate number of adults return to sustain the run. The majority of adult fish returning during the 1995/96 run year are from the 1990/91 and 1991/92 brood years which are the last years that spawning escapement exceeded 200 fish. Future runs will be drawing from much smaller numbers of spawning adults and therefore it is very important from a diversity standpoint to maintain as many adults as possible. The 1996/97 run may be less than 100 steelhead (if there is no predation). Treaty Indian and sport fisheries that may impact the returning wild winter-run steelhead have been closed. The remaining exploiter of these returning adult fish that needs to be controlled is the sea lions. Given the depressed spawning escapements in the last three years, it is important to protect as many of the spawners from this year's run as possible to ensure the viability of this run. Although there are a number of factors that may be contributing to the current decline, the adult spawner vulnerability to predation by sea lions at the Locks is a principal factor that must be addressed in order to increase spawning escapement.

Data collected on marked sea lions demonstrates that only a few California sea lions are responsible for the problems at the Ballard Locks. Most of the 255 sea lions that have been marked for identification in Shilshole Bay have not been observed foraging at the Ballard Locks (Appendix A). Available information indicates that the few sea lions that have preyed on returning steelhead in the past at the Locks, and repeatedly return to the Locks area to forage in spite of deterrence efforts, are likely to kill winter steelhead at the Locks when steelhead are available (January 1 to May 31), and therefore have a significant negative impact on the status and recovery of the winter steelhead population. For example, sea lion #17, which was originally identified (marked) in 1989, has been observed foraging and successfully preying on steelhead in the Ship Canal every year since 1989 (except 1995 when it was captured and put in captivity) and appears to be unaffected by the intense deterrence efforts. Sea lion #17 was observed foraging in the ensonified zone during the 1992/93 acoustic barrier test and successfully took fish in the ensonified zone (Pfeifer 1994c).

In 1993/94, #17 was present at the Locks all season (Pfeifer 1994d). Sea lion #17 was captured and placed in temporary captivity in 1995, released after the steelhead run, only to return to the Locks the next season. Based on past behavior, it is clear that #17 will continue to kill winter steelhead at the Locks if he is not removed. Sea lion #87 is another example of a sea lion that needs to be permanently removed from the Locks area. Sea lion #87, which was marked in January 1995, was sighted repeatedly at the Locks during the 1994/95 steelhead run and foraged in the inner bay area in spite of deterrence efforts. This sea lion was likely in the Locks area prior to 1995, but could not have been individually identified due to lack of marks. Although #87 has not yet been confirmed to have killed a steelhead, based on its persistent foraging behavior in the area, it is very possible that it could have killed a steelhead, but not have been observed (i.e., predation occurred when observers were not present or just was not seen), or it is possible that #87 was one of the unidentified sea lions that was observed killing steelhead. Further, even though sea lion #87 was exposed to the acoustic barrier and firecracker harassment, it still repeatedly foraged in the Locks area and was observed preying on smolts and killing adult sockeye salmon in May and June 1995. Sea lion #87 then returned to the Locks in the fall of 1995 and was observed killing coho salmon and consumed four coho during a two hour period inside the ensonified zone. Sea lion #87 exhibits foraging behavior at the Locks that is similar to sea lion #17, and is expected to return to the Locks whenever salmonids are present and will prey on steelhead, when available, in spite of deterrence efforts.

With a total projected wild run of only 146 fish, even one predatory sea lion can consume a significant percentage of the run if predation is allowed to continue unabated. Data collected during the 1985/86 steelhead run demonstrate that a single California sea lion can kill and consume 12 steelhead during an eight hour period at the Locks. Based on this and the expected low return, it is reasonable to conclude that any sea lion that meets the proposed definition of "predatory" either has had a negative impact on the steelhead run, or will have a significant impact on the status and recovery of the wild steelhead population if not removed.

The proposed action incorporates sufficient flexibility for the State to proceed under its authorization to remove predatory animals and protect steelhead, without the constraints of the previously issued condition requiring real time monitoring of take rate. The predation rate "trigger" essentially required steelhead mortalities to occur before action could be taken thereby allowing sea lions to forage and kill steelhead before preventative action could be taken, resulting in higher steelhead mortalities. In addition, even if the "trigger" is activated by a sea lion, the animal may not be available for capture for some time and could continue killing steelhead. Also, as described in

the 1995 EA, the "trigger" was found to be insensitive owing to limitations of the available equipment. Uncertainties surrounding counts by the automated fish counter, i.e., high fish tallies because of non-steelhead passage or counter malfunctions, low fish tallies because of fish avoiding the counter tunnel or counter malfunctions, combined to create a cumbersome and labor intensive method for identifying individual candidates for removal.

VI.D. Consider the extent to which such pinnipeds are exhibiting behavior that presents an ongoing threat to public safety.

The California sea lions preying on steelhead in the Locks area are not a threat to public safety. However, capturing and handling these large and occasionally aggressive animals does present a clear danger to the personnel involved. To date, the opportunistic capture of over 200 sea lions for marking has gone well. However, circumstances are different when certain sea lions are targeted for capture especially those that have been captured before and may react aggressively to attempts to capture them again. For example, sea lion #17 weighed in excess of 1000 pounds at the time of his release and became increasingly more difficult to handle during captivity. The potential for injury to personnel is multiplied each time an animal is captured because the sea lion can become more aware of the routine, and have more opportunity to test where the "weak link" in process might be.

Temporary captive holding increases the risks to human safety for personnel because handling the animals during transfers, medical examinations etc. all provide potential situations for accidents to occur. Following release, the animals will return and captures will again be required. Animals which have been captured and handled previously may not subject themselves to capture using the same (haul-out trapping) techniques in subsequent years. Therefore, active capture methods involving tangle nets and tranquilizing drugs may be necessary. Active capture methods present the greatest risk to personnel. For these reasons, capturing sea lions involves the greatest risk to people, and it is further confounded when sea lions return subsequent to temporary captive holding or relocation efforts.

VII. FINDING OF NO SIGNIFICANT IMPACT

This EA considers the environmental consequences of four alternatives for potentially implementing lethal removal of California sea lions that forage on wild winter-run steelhead at the Ballard Locks. The proposed action is a modification of the existing criteria for if and when lethal removal of California sea lions should be undertaken after non-lethal deterrence efforts have failed to prevent "predatory" sea lions from foraging at the Locks during the winter steelhead run. Lethal removal under all four alternatives is a last resort for "predatory" animals which have developed a successful foraging strategy for steelhead at the Locks that cannot be deterred by non-lethal means such as the acoustic barrier, and which have returned to forage at the Locks during the time when winter steelhead may be present. The proposed action eliminates the condition that "predatory" sea lions be captured and temporarily placed in captivity for the duration of the steelhead run.

The proposed action and the alternatives will have no effect on the physical characteristics of the geographic area nor will it cause the loss or destruction of significant scientific, cultural or historic resources. California sea lions that are targeted for lethal removal would be taken away from public areas and therefore the action will have no effects on public health or safety, except for the risks of injury to the State/federal personnel involved in the capture and handling of California sea lions.

The proposed action is based on considerable experience and scientific information collected on California sea lions and winter steelhead at the Locks over the past ten years. Accordingly, the action is unlikely to have unique or unknown risks. The proposed action and alternatives were developed in accordance with and under the authority of Section 120 of the MMPA. The proposed action does not establish a precedent for future actions beyond the sea lion-steelhead conflict at the Ballard Locks because the provisions of Section 120 can only be applied under very specific conditions. Applications for lethal removal in future situations have to be considered on a relatively strict case-by-case basis in accordance with procedures set forth in Section 120. There is both public opposition and public support for the proposed action; it ranges from those who object to any actions (non-lethal or lethal) taken with sea lions to those who would agree with lethal removal under limited circumstances to those who believe the number of California sea lions migrating into Puget Sound needs to be reduced by whatever means. There is no scientific controversy over the effect of the proposed action on sea lions and the rest of the environment. The proposed action authorizes the lethal removal of a small number of California sea lions and will have no appreciable effect on the U.S. stock of California sea lions,

or the portion of the stock that seasonally occupies Puget Sound, as discussed below. The proposed action is structured such that it limits lethal removal to only the identifiable sea lions that are having a significant negative impact on the status and recovery of winter steelhead, five of which would be identified in the Letter of Authorization and others would be determined by the State on a case-by-case basis with NMFS concurrence. The number of sea lions killed is unlikely to exceed 5-10 animals over the next two years (timeframe of the Letter of Authorization). Nonetheless, if 15 sea lions are removed, the Letter of Authorization requires that lethal removal will cease and NMFS will reconvene the Task Force for the purpose of evaluating the effectiveness of the measures implemented and making recommendations on further actions.

No endangered or threatened species or their critical habitat will be adversely affected by the proposed action or alternatives. NMFS has been petitioned to list west coast steelhead populations under the ESA, but a decision on whether to propose listing has not yet occurred. Although marbled murrelets, a threatened species, have been sighted in Shilshole Bay at the entrance to the Lake Washington Ship Canal, there are no activities under the proposed action or alternatives that may affect them. Seabirds have been observed foraging in the "ensonified" area (caused by acoustic array) of the Locks. No noticeable change in seabird behavior has been observed relative to the operation of the acoustic devices. The acoustic devices have been tested on fish and caused no reaction. Tests on the effective range of the acoustic devices conducted in 1995 indicate the sounds generated by the devices are not detectable outside the Lake Washington Ship Canal. The proposed action and alternatives will have no effect on Steller sea lions, which are listed as threatened, except that the acoustic deterrence devices may possibly cause them to avoid the Ship Canal. Steller sea lions have been observed to enter the Lake Washington Ship Canal on a few occasions, but Steller sea lions have never been observed or reported foraging at the Locks and no activities are directed at this species. Harbor seals are the only other marine mammal observed in the Locks area and the acoustic devices would be expected to deter them from the Locks area. The present authorization for lethal removal under Section 120 of the MMPA is specific to California sea lions; however, non-lethal efforts under Section 109(h) of the MMPA may be applied to harbor seals that occur in the fishway, thereby affecting steelhead passage.

The proposed action and alternatives are necessary to prevent sea lions from impacting the recovery of the Lake Washington winter steelhead. The wild steelhead population has declined dramatically in recent years to an all time low spawning escapement of 70 steelhead in 1993/94. The steelhead run is predicted to be only 146 fish this year and future runs are likely to be smaller (e.g., less than 100 steelhead returning in 1996/97). There is concern that there is substantial risk for

the recovery of the Lake Washington winter steelhead population based on the low returns of steelhead over the past two years. Because of the precarious status of the population this year and in coming years, every returning steelhead may now be critical to the recovery process and no avoidable loss of steelhead from sea lion predation should be allowed. Although adequate spawning habitat is available, steelhead escapement goals have not been met for the Lake Washington basin for the past 9 years. The proposed action will benefit not only the Lake Washington winter steelhead, but also the larger steelhead population in Puget Sound. The National Research Council has emphasized the importance of local breeding units within metapopulations as the fundamental unit of replacement for anadromous salmon. Incremental loss of components of a metapopulation is a concern because each loss diminishes the scope of genetic variation. The genetic variability within a population represents the reservoir upon which future evolutionary development depends. An adequate number of individuals for each local reproductive population is needed to ensure persistence of the many reproductive units that make up a fish stock. The numbers of returning Lake Washington steelhead have now declined to levels below the 150 fish threshold indicated by the Biological Requirements Work Group (BRWG 1994) as critical for the successful recovery of small salmonid populations. Repeated spawning returns of less than 150 fish suggests that the continued survival of the population appears to be highly uncertain. Therefore it is necessary to eliminate avoidable losses to the maximum extent possible.

Action to minimize or eliminate sea lion predation on steelhead by these few sea lions at the Locks facility is necessary because data clearly show that a few animals can penetrate the acoustic barrier and continue to prey on returning adult steelhead in spite of deterrence efforts. The proposed action is to lethally remove only the individually identifiable sea lions that have been observed to prey on returning steelhead in the Lake Washington Ship Canal and which have returned to forage in the ensonified zone during the steelhead run. This restriction on application would limit the effects of the proposed action to a small number of sea lions. Further, the acoustic devices are designed to "screen-out" new animals that have not developed a preference for preying on steelhead at this site. This approach minimizes the possibility of replacement of these "predatory" sea lions by new entrants. Past data indicates that although hundreds of animals may occur in the Shilshole Bay area, only a few of these routinely enter the Locks area; of those sea lions that enter the Locks area, only 3 to 5 are responsible for most of the predation that occurs each year. The lethal removal of small numbers of male California sea lions is negligible in relation to the overall sea lion population size and status. The potential number of lethal removals (5 to 10) also is insignificant when compared to the peak counts of sea lions in Puget Sound. The potential number of lethal removals is far below the Potential Biological Removal (PBR) level of 5,052

established for California sea lions (the PBR is a threshold level used by NMFS to assess when human induced mortalities may be impacting a marine mammal population). Further, the lethal removal at the Locks would be applied only to a very small number of male sea lions (as essentially only males occur in Northwest waters) and therefore because of the polygamous breeding behavior of this species, the removal of a few males would have no effect on the reproductive status of the population. Lastly, the sea lions to be lethally removed will be provided to a treaty Indian tribe that otherwise would be taking the same numbers of sea lions for subsistence use.

The proposed action eliminates the captive holding requirement because it is not a prudent alternative for eliminating the predation problem. Based on past data showing repeated returns annually of sea lions to the Locks and especially the results of last year's experimental captive holding effort (with sea lion #17), it is known that "predatory" sea lions will return to the Locks after release from captivity and repeat past predatory behavior at the Locks that threatens the viability of the winter steelhead run. There are a number of problems inherent with recapturing these predatory sea lions that place the steelhead at greater risk. First, the sea lions may become "trap-shy" and avoid capture while continuing to predate steelhead. Sea lion #17, which is actively foraging at the Locks this season (1995/96), has been observed hauling-out on a bell buoy, rather than the trap, and may not be available for capture. This animal is a threat to steelhead with his foraging in front of the fish ladder, in spite of non-lethal harassment efforts. Second, in the interim periods until recapture, the "predatory" sea lions will kill steelhead if they are available. In the past, considerable time has lapsed before "target" animals were available for capture (and in some cases they were never available), and many steelhead can be killed during these periods. Third, observations indicate that "naive" sea lions will quickly learn to not react to the acoustic devices if these naive animals enter the area at the time that a "predatory" sea lion is penetrating the ensonified zone. "Naive" sea lions that approach the acoustic barrier normally turn and leave the area unless their behavior is affected by the behavior of "learned" sea lions. Because of this, there is a greater potential for replacement of predatory sea lions if the "repeat offender" predatory animals are not removed (permanently) as quickly as possible. Last, there is the issue of human safety. There is always a risk to the people involved in handling these animals. However, the more times the sea lions have to be captured and handled, the greater the risk to the people involved.

Overall, the numbers of male California sea lions that may be involved in lethal removal at the Locks is extremely small in comparison to the overall California sea lion population and therefore is insignificant and would have no detectable effect on the size or status of the west coast California sea lion

population.

For these reasons and those described in more detail in this EA, it is hereby determined that neither approval nor implementation of the modified lethal removal criteria will significantly affect the quality of the human environment, and that preparation of an environmental impact statement on this action is not required by Section 102(2) of the National Environmental Policy Act or its implementing regulations.

March 12, 1996
Date

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VIII. COORDINATION AND CONSULTATION

The 1996 EA is a supplement to the 1995 EA (NMFS and WDFW 1995) which included extensive consultations and coordination with various programs and offices in NOAA, NMFS, WDFW, USFWS, the Corps, and the Muckleshoot and Suquamish Indian tribes, as well as with acoustic experts from Airmar Technology Corp.

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APPENDIX A. RESIGHTS OF IDENTIFIABLE CALIFORNIA SEA LIONS

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
1	Jan. 14-15, 17-18, 1989	*Ballard Locks, WA
	Jan. 20-21, 1989	*Ballard Locks, WA
	Jan. 28-29, 1989	*Ballard Locks, WA
	Feb. 03,12, 1989	*Ballard Locks, WA
	Feb. 15, 1989	Captured Shilshole Bay, WA (398 lbs)
	Feb. 16, 1989	Released Klipsan Beach, WA
	Mar. 09, 1989	Hood Canal, WA
	May 20, 1989	Shilshole Bay, WA
2	Feb. 09, 1989	Dart tag, Shilshole Bay, WA
	Feb. 10-14, 1989	Ballard Locks, WA
	Feb. 15, 1989	Captured Shilshole Bay, WA (548 lbs); this animal died during recovery from anesthesia.
3	Feb. 16, 1989	Captured Shilshole Bay, WA (572 lbs)
	Feb. 18, 1989	Released Klipsan Beach, WA
	Mar. 20, 1989	Everett, WA
	Apr. 03, 1989	Everett, WA
	Apr. 13, 1989	Shilshole Bay and Everett, WA
	May 26, 1989	Everett, WA
4	Jan. 27, 1989	Dart tag, Shilshole Bay, WA
	Jan. 28-29, 1989	Shilshole Bay, WA
	Feb. 16, 1989	Captured Shilshole Bay, WA (629 lbs); this animal died during recovery from anesthesia.
5	Feb. 20, 1989	Captured Shilshole Bay, WA (525 lbs)
	Feb. 21, 1989	Released Klipsan Beach, WA
	Mar. 06, 1989	Shilshole Bay, WA
	Mar. 13, 1989	Everett, WA
	Mar. 24, 1989	Recaptured Shilshole Bay, WA (580 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Apr. 03, 1989	Everett, WA
	Apr. 13,17,18, 1989	Everett, WA
	May 02, 1989	Shilshole Bay, WA
	May 26, 1989	Everett, WA
	Feb. 22, 1990	Everett, WA
	Mar. 15-16, 1990	Everett, WA
	May 07, 1990	Everett, WA
	Oct. 11, 1990	Shilshole Bay, WA
	Dec. 06, 1990	Everett, WA
	Jan. 04,22, 1991	Everett, WA
	Mar. 20, 1991	Everett, WA
	Apr. 16, 1991	Everett, WA
6	Feb. 13, 1989	Dart tag, Shilshole Bay, WA
	Feb. 17, 1989	Ballard Locks, WA
	Feb. 20, 1989	Captured Shilshole Bay, WA (615 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Feb. 21, 1989	Released Klipsan Beach, WA
	Mar. 10, 1989	Transmitter Recovered Shilshole Bay, WA
	Mar. 21,28, 1989	Everett, WA
	Apr. 09, 1989	Shilshole Bay, WA
	Apr. 14, 1989	Elliott Bay, WA
	Apr. 17, 1989	Shilshole Bay, WA; Elliott Bay, WA
	Feb. 5,21, 1990	*Ballard Locks, WA
	Dec. ?, 1993	Everett, WA
7	Jan. 27, 1989	Dart tag, Shilshole Bay, WA
	Jan. 28-29, 1989	Shilshole Bay, Wa
	Feb. 11, 1989	Shilshole Bay, Wa
	Feb. 20, 1989	Captured Shilshole Bay, WA (521 lbs)
	Feb. 21, 1989	Released Klipsan Beach, WA
	Mar. 03, 1989	Ballard Locks, WA
	Mar. 04, 1989	Shilshole Bay, WA
	Mar. 13,21, 1989	Everett, WA
	Apr. 11, 1989	Shilshole Bay, WA
	Apr. 12,19,23, 1989	Everett, WA
	Dec. 13-14, 1989	Everett, WA
	Feb. 22,24, 1990	Everett, WA
	Apr. 12, 1990	Everett, WA
	May 05, 1990	Everett, WA
	Dec. 05, 1990	Shilshole Bay, WA
	Dec. 06, 1990	Everett, WA
	Mar. 20, 1991	Everett, WA
	Dec. ?, 1993	Everett, WA
	Apr. 11, 1994	Shilshole Bay, WA
	May 01,23, 1994	Shilshole Bay, WA
	Oct. 18, 1995	Everett, WA
8	Feb. 24, 1989	Captured Shilshole Bay, WA (470 lbs)
	Feb. 25, 1989	Released Klipsan Beach, WA
	Mar. 12, 1989	Everett, WA
	Mar. 21, 1989	Everett, WA
	Apr. 07, 1989	Duwamish Waterway, WA
	Apr. 10, 1989	Elliott Bay, WA
	Apr. 13,14, 1989	Shilshole Bay, WA
	Dec. 13, 1989	Everett, WA
	Dec. 22, 1989	Ballard Locks, WA
	Jan. 11, 1990	Everett, WA
	Feb. 22,24, 1990	Everett, WA
	Mar. 07, 1990	Everett, WA
	Apr. 05, 1990	Shilshole Bay, WA
	Dec. 06, 1990	Everett, WA
	Mar. 20, 1991	Everett, WA
	Apr. 12, 1991	Shilshole Bay, WA
	Apr. 17, 1991	Everett, WA
	Nov. 16, 1993	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
9	Feb. 13, 1989	Dart tag, Shilshole Bay, WA
	Feb. 17, 1989	Ballard Locks, WA
	Feb. 24, 1989	Captured Shilshole Bay, WA (609 lbs)
	Feb. 25, 1989	Released Klipsan Beach, WA
	Mar. 12, 1989	Everett, WA
	Mar. 21, 1989	Everett, WA
	Mar. 23, 1989	Shilshole Bay, WA
	Mar. 24, 1989	Recaptured Shilshole Bay, WA (605 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Apr. 03, 1989	Everett, WA
	Apr. 07-12,14, 1989	Shilshole Bay, WA
	Apr. 17,18, 1989	Shilshole Bay, WA
	Jan. 11, 1990	Everett, WA
	Mar. 15, 1990	Everett, WA
	Mar. 18, 1990	Ballard Locks, WA
	Dec. 06-07, 1990	Everett, WA
	Dec. 12, 1990	Shilshole Bay, WA
	Feb. 05, 1991	Ballard Locks, WA
	Feb. 06, 1991	Everett, WA
	Dec. 30, 1991	Everett, WA
	Jan. 30, 1994	Found dead Whidbey Is., WA
10	Feb. 24, 1989	Captured Shilshole Bay, WA (666 lbs)
	Feb. 25, 1989	Released Klipsan Beach, WA
	Mar. 05, 1989	Shilshole Bay, WA
	Mar. 06, 1989	Shilshole Bay, WA
	Mar. 10, 1989	Recaptured Shilshole Bay, WA (635 lbs)
	Mar. 10, 1989	Released Klipsan Beach, WA
	Mar. 22, 1989	Recaptured (12 days) Shilshole (600 lbs)
	Mar. 23, 1989	Released Klipsan Beach, WA
	Apr. 03, 1989	Everett, WA
	Apr. 17, 1989	Edmonds, WA
	Apr. 24, 1989	Shilshole Bay, WA
	May 15,20 1989	Shilshole Bay, WA
11	Feb. 27, 1989	Captured Shilshole Bay, WA (636 lbs)
	Feb. 28, 1989	Released Klipsan Beach, WA
	Mar. 13, 1989	Recaptured (13 days) Shilshole (580 lbs)
	Mar. 14, 1989	Released Klipsan Beach, WA
	Mar. 22, 1989	Recaptured (8 days) Shilshole (550 lbs)
	Mar. 23, 1989	Released Klipsan Beach, WA
	Mar. 30, 1989	Shilshole Bay, WA
	Apr. 01, 1989	Ballard Locks, WA
	Apr. 02,04, 1989	Shilshole Bay, WA
	Apr. 06, 1989	Recaptured Shilshole Bay, WA (595 lbs)
	Apr. 07, 1989	Released Klipsan Beach, WA
	May 03, 1989	Shilshole Bay, WA
12	Feb. 27, 1989	Captured Shilshole Bay, WA (708 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Feb. 28, 1989	Released Klipsan Beach, WA
	Dec. 29, 1989	Ballard Locks, WA
	Jan. 11, 1990	Everett, WA
	Mar. 16, 1990	Everett, WA
	Apr. 12, 1990	Everett, WA
	May 07, 1990	Everett, WA
13	Feb. 27, 1989	Captured Shilshole Bay, WA (653 lbs)
	Feb. 28, 1989	Released Klipsan Beach, WA
	Mar. 21, 1989	Everett, WA
	Mar. 28, 1989	Everett, WA
	Apr. 03, 1989	Everett, WA
	Apr. 14, 1989	Shilshole Bay, WA
	Apr. 17-18, 1989	Everett, WA
	Apr. 28,29, 1989	Shilshole Bay, WA
	May 03,12, 1989	Shilshole Bay, WA
	Jan. 14, 1990	Everett, WA
	Apr. 09,12, 1990	Everett, WA
	Dec. 06, 1990	Everett, WA
	Mar. 27, 1991	Everett, WA
	Dec. ?, 1993	Everett, WA
14	Mar. 06, 1989	Captured Shilshole Bay, WA (660 lbs)
	Mar. 07, 1989	Released Klipsan Beach, WA
	Mar. 20, 1989	Race Rocks, B.C.
	Mar. 28, 1989	Shilshole Bay, WA
	Mar. 29, 1989	Recaptured Shilshole Bay, WA (535 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Apr. 13, 1989	Shilshole Bay, WA
	Apr. 17,19,22, 1989	Shilshole Bay, WA
	Apr. 24-26, 1989	Shilshole Bay, WA
	May 15,20, 1989	Shilshole Bay, WA
	Mar. 15, 1990	Everett, WA
	Apr. 12, 1990	Everett, WA
	Apr. 24, 1990	Shilshole Bay, WA
	Dec. 12,14, 1990	Shilshole Bay, WA
	Jan. 22, 1991	Everett, WA
	Mar. 27, 1991	Everett, WA
	Dec. 30, 1991	Everett, WA
	Apr. 07,25, 1994	Shilshole Bay, WA
	Apr. 03, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	May 19, 1995	Shilshole Bay, WA
	May 23, 1995	Shilshole Bay, WA
	Jun. 07, 1995	Shilshole Bay, WA
	Jun. 09, 1995	Shilshole Bay, WA
15	Feb. 13, 1989	Dart tag, Shilshole Bay, WA
	Feb. 17, 1989	*Ballard Locks, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Mar. 06, 1989	Captured Shilshole Bay, WA (618 lbs)
	Mar. 07, 1989	Released Klipsan Beach, WA
	Mar. 18, 1989	Ballard Locks, WA
	Mar. 19-22, 1989	Ballard Locks, WA
	Mar. 23, 1989	Shilshole Bay, WA
	Mar. 24, 1989	Recaptured Shilshole Bay, WA (605 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Mar. 31, 1989	*Ballard Locks, WA
	Apr. 01-07, 1989	*Ballard Locks, WA
	Apr. 09,11, 1989	Shilshole, WA
	Apr. 11-12, 1989	Ballard Locks, WA
	Apr. 14,17,24, 1989	Shilshole, WA
	Apr. 15,18,26, 1989	Ballard Locks, WA
	Apr. 22,24,29, 1989	Shilshole Bay, WA
	Dec. 06,08,19, 1989	Ballard Locks, WA
	Dec. 11, 1989	West Point, WA
	Feb. 1990	Found dead, Whidbey Island, WA
16	Mar. 06, 1989	Captured Shilshole Bay, WA (420 lbs)
	Mar. 07, 1989	Released Klipsan Beach, WA
	Mar. 14, 1989	Shilshole Bay, WA
	Mar. 23, 1989	Shilshole Bay, WA
	Mar. 24, 1989	Recaptured Shilshole Bay, WA (390 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Mar. 29, 1989	Recaptured (5 days) Shilshole (385 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Apr. 05, 1989	Ballard Locks, WA
	Apr. 06, 1989	Recaptured Shilshole Bay, WA (435 lbs)
	Apr. 07, 1989	Released Klipsan Beach, WA
	Apr. 17, 1989	Shilshole Bay, WA
	Apr. 18,26, 1989	Shilshole Bay, WA
	Apr. 28,29, 1989	Shilshole Bay, WA
	May 29, 1989	San Miguel Is., CA
	May 30-31, 1989	San Miguel Is., CA
	Jun. 01-26, 1989	San Miguel Is., CA
17	Mar. 04, 1989	Ballard Locks, WA
	Mar. 08, 1989	Captured Shilshole Bay, WA (400 lbs)
	Mar. 08, 1989	Released Klipsan Beach, WA
	Mar. 20, 1989	*Ballard Locks, WA
	Mar. 21-24,26-30, 1989	*Ballard Locks, WA
	Apr. 03,06, 1989	Ballard Locks, WA
	Apr. 06, 1989	Shilshole Bay, WA (escaped capture)
	Apr. 07-18, 1989	*Ballard Locks, WA
	Apr. 17,26, 1989	Shilshole Bay, WA
	Apr. 20, 1989	Ballard Locks, WA
	Dec. 18,23,26, 1989	*Ballard Locks, WA
	Jan. 16,17,20, 1990	Ballard Locks, WA
	Jan. 18, 1990	Shilshole Bay, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jan. 22-25,27-29, 1990	*Ballard Locks, WA
	Feb. 08, 1990	Shilshole Bay, WA
	Feb. 11,21,23-24,1990	*Ballard Locks, WA
	Feb. 26, 1990	Ballard Locks, WA
	Mar. 01,08,11-12, 1990	*Ballard Locks, WA
	Mar. 13, 1990	Recaptured Shilshole Bay, WA (649 lbs)
	Mar. 21, 1990	Released San Miguel Island, CA
	Mar. 22-28, 1990	San Miguel Is., CA
	Dec. 06, 1990	Everett, WA
	Dec. 31, 1990	Ballard Locks, WA
	Jan. 04,17, 1991	Ballard Locks, WA
	Jan. 22, 1991	Everett, WA
	Jan. 24,28-31, 1991	*Ballard Locks, WA
	Feb. 4-7,13,19, 1991	Ballard Locks, WA
	Feb. 22,26-28, 1991	Ballard Locks, WA
	Mar. 07,13-14, 1991	Ballard Locks, WA
	Mar. 20,25-27, 1991	Ballard Locks, WA
	Apr. 01,10,15, 1991	Ballard Locks, WA
	Apr. 16, 1991	Everett, WA
	Apr. 19,24,26,29-30,1991	Ballard Locks, WA
	May 01-03,8-10, 1991	Ballard Locks, WA
	Dec. 16-17,20, 1992	*Ballard Locks, WA
	Dec. 21,24 1992	*Ballard Locks, WA
	Jan. 27,28,29,31, 1993	*Ballard Locks, WA
	Feb. 01-05, 1993	*Ballard Locks, WA
	Mar. 05,09-13,15,1993	*Ballard Locks, WA
	Dec. 17,20,22, 1993	Ballard Locks, WA
	Dec. 28-29,31, 1993	Ballard Locks, WA
	Jan. 01-03,06-07, 1994	Ballard Locks, WA
	Jan. 10,16,20,23, 1994	Shilshole Bay, WA
	Jan. 29,31, 1994	Ballard Locks, WA
	Feb. 03-04,09,11, 1994	Ballard Locks, WA
	Feb. 17, 1994	Ballard Locks, WA
	Feb. 08, 1994	Shilshole Bay, WA
	Mar, 9-10,12,24, 1994	Ballard Locks, WA
	Apr. 07,30, 1994	Shilshole Bay, WA
	Apr. 21, 1994	Ballard Locks, WA
	May 06-07,12, 1994	Ballard Locks, WA
	Jan. 25, 1995	Recaptured Shilshole Bay, WA (870 lbs)
	Jan. 26 - Jun. 07, 1995	In captivity
	Jun. 08, 1995	Released in Straits (1082 lbs)
	Jun. 25, 1995	San Miguel Is., CA
	Jun. 26 - Aug. 03, 1995	San Nicolas Is., CA
	Sep. 12, 1995	Folger Is., B.C.
	Nov. 26, 1995	Shilshole Bay, WA
	Jan. 10, 1996	Ballard Locks, WA
	Jan. 18, 1996	Shilshole Bay, WA
	Jan. 18, 1996	Ballard Locks, WA
	Jan. 19, 1996	Ballard Locks, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jan. 20, 1996	Ballard Locks, WA
	Jan. 21, 1996	*Ballard Locks, WA
18	Mar. 08, 1989	Captured Shilshole Bay, WA (575 lbs)
	Mar. 08, 1989	Released Klipsan Beach, WA
	Mar. 22, 1989	Shilshole Bay, WA
	Mar. 23-24,26-31, 1989	Shilshole Bay, WA
	Apr. 1-7,09-11,13, 1989	Shilshole Bay, WA
	Apr. 17-18,24, 1989	Shilshole Bay, WA
	Apr. 28-29, 1989	Shilshole Bay, WA
	May 03,15,20,21, 1989	Shilshole Bay, WA
19	Mar. 08, 1989	Captured Shilshole Bay, WA (520 lbs)
	Mar. 08, 1989	Released Klipsan Beach, WA
	Mar. 14, 1989	Shilshole Bay, WA
	Mar. 16-18,20-22, 1989	*Ballard Locks, WA
	Mar. 23, 1989	Shilshole Bay, WA
	Mar. 24-31, 1989	*Ballard Locks, WA
	Apr. 01-02, 1989	*Ballard Locks, WA
	Apr. 03, 1989	Everett, WA
	Apr. 05-12, 1989	Ballard Locks, WA
	Apr. 13, 1989	Shilshole Bay, WA
	Apr. 14, 1989	Ballard Locks, WA
	Apr. 17, 1989	Everett, WA
	Apr. 19,22,26, 1989	Ballard Locks, WA
	May 15, 1989	Ballard Locks, WA
	Jul. 16, 1989	San Miguel Is., CA
	Nov. 05, 1989	Ballard Locks, WA
	Dec. 01-02,09,22	Ballard Locks, WA
	Dec. 13, 1989	Everett, WA
	Jan. 03,09,10,30, 1990	Ballard Locks, WA
	Jan. 11, 1990	Everett, WA
	Feb. 06-8,12, 1990	Ballard Locks, WA
	Feb. 24,28 1990	Ballard Locks, WA
	Mar. 01-04,08,13, 1990	*Ballard Locks, WA
	Mar. 21-22,24-28, 1990	*Ballard Locks, WA
	Mar. 30, 1990	Ballard Locks, WA
	Mar. 07,15, 1990	Everett, WA
	Apr. 02-03,09,11, 1990	*Ballard Locks, WA.
	Apr. 12, 1990	Everett, WA
	Apr. 13,18-21, 1990	*Ballard Locks, WA
	Apr. 24-28, 1990	*Ballard Locks, WA
20	Mar. 08, 1989	Captured Shilshole Bay, WA (580 lbs)
	Mar. 08, 1989	Released Klipsan Beach, WA
	May 14, 1989	Tag Recovered in N. California
	Jan. 14, 1990	Everett, WA
21	Mar. 09, 1989	Captured Shilshole Bay, WA (565 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Mar. 10, 1989	Released Klipsan Beach, WA
	Mar. 28, 1989	Everett, WA
	Mar. 30, 1989	Ballard Locks, WA
	Apr. 06, 1989	Recaptured Shilshole Bay, WA (640 lbs)
	Apr. 07, 1989	Released Klipsan Beach, WA
	Apr. 14, 1989	Shilshole Bay, WA
	Apr. 17, 1989	Everett, WA
	Apr. 26, 1989	Shilshole Bay, WA
	May 03, 1989	Shilshole Bay, WA
	Jan. 20, 1990	Everett, WA
	Feb. 24, 1990	Shilshole Bay, WA
	Mar. 12, 1990	Recaptured Shilshole Bay, WA (594 lbs)
	Mar. 21, 1990	Released at San Miguel Island, CA
	Mar. 22-24, 1990	San Miguel Is., CA
	May 04, 1990	Everett, WA
	May 05, 1990	Everett, WA
	Jun. 27, 1990	San Miguel Is., CA
	Jul. 23, 1990	San Miguel Is., CA
	Jan. 04, 1991	Everett, WA
22	Mar. 09, 1989	Captured Shilshole Bay, WA (550 lbs)
	Mar. 10, 1989	Released Klipsan Beach, WA
	Mar. 29, 1989	Recaptured Shilshole (585 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Jul. 04, 1989	San Nicolas Is. CA
	Dec. 11, 1989	Shilshole Bay, WA
	Mar. 12, 1990	Recaptured Shilshole Bay, WA (836 lbs)
	Mar. 21, 1990	Released at San Miguel Island, CA
	Mar. 22 - Apr 03, 1990	San Miguel Island, CA
	May 03, 1990	Alki Point, WA
	May 18, 1990	Tag Recovered at Rich Passage, WA
	Dec. 05, 1990	Shilshole Bay, WA
23	Mar. 09, 1989	Captured Shilshole Bay, WA (560 lbs)
	Mar. 10, 1989	Released Klipsan Beach, WA
	Mar. 22, 1989	Recaptured Shilshole (540 lbs)
	Mar. 23, 1989	Released Klipsan Beach, WA
	Apr. 09,10, 1989	Shilshole Bay, WA
	Apr. 12, 1989	Three Tree Pt., WA
	Jul. 10, 1989	San Miguel Is., CA
	Dec. 07, 1989	Shilshole Bay, WA
	Dec. 18,28, 1989	Shilshole Bay, WA
	Jan. 18-21,30-31 1990	*Ballard Locks, WA
	Feb. 13-14,20-21 1990	*Ballard Locks, WA
	Feb. 24, 1990	Shilshole Bay, WA
	Mar. 03,07, 1990	Shilshole Bay, WA
	Apr. 24, 1990	Shilshole Bay, WA
	May 05, 1990	Everett, WA
	May 09, 1990	Shilshole Bay, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Dec. 05, 1990	Shilshole Bay, WA
	Jan. 03, 1991	Shilshole Bay, WA
	Jan. 04,05,22, 1991	Everett, WA
24	Mar. 10, 1989	Captured Shilshole Bay, WA (675 lbs)
	Mar. 10, 1989	Released Klipsan Beach, WA
	Mar. 24, 1989	Recaptured Shilshole (655 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Apr. 01, 1989	Ballard Locks, WA
	Apr. 04, 1989	Shilshole Bay, WA
	Apr. 10, 1989	Everett, WA
	Apr. 18,24,26, 1989	Shilshole Bay, WA
	Jun. 23, 1989	Found Dead, Eureka, CA
25	Dec. 28-29, 1988	*Ballard Locks, WA
	Jan. 08,14-15, 1989	Ballard Locks, WA
	Jan. 20-22,26, 1989	*Ballard Locks, WA
	Jan. 28-30, 1989	*Ballard Locks, WA
	Feb. 03,05,12,	Ballard Locks, WA
	Feb. 19,21,27 1989	Ballard Locks, WA
	Mar. 03-04,07,11, 1989	Ballard Locks, WA
	Mar. 13, 1989	Captured Shilshole Bay, WA (675 lbs)
	Mar. 14, 1989	Released Klipsan Beach, WA
	Mar. 20, 1989	Race Rocks, B.C.
	Mar. 28, 1989	Ballard Locks, WA
	Mar. 29, 1989	Lake Washington
	Mar. 30-31, 1989	*Ballard Locks, WA
	Apr. 01-11, 1989	*Ballard Locks, WA
	Apr. 13-16, 1989	Ballard Locks, WA
	Apr. 17, 1989	Shilshole Bay, WA
	Apr. 18-21, 1989	*Ballard Locks and Shilshole Bay, WA
	Apr. 24-29, 1989	*Ballard Locks, WA
	May 02,04,05, 1989	*Ballard Locks, WA
	Jul. 11, 1989	San Miguel Is., CA
	Nov. 05, 1989	Ballard Locks, WA
	Dec. 02,04,06,08, 1989	*Ballard Locks, WA
	Dec. 09,11-12, 1989	*Ballard Locks, WA
	Dec. 13, 1989	Everett, WA
	Dec. 14-15,22,26, 1989	*Ballard Locks, WA
	Dec. 29,31, 1989	*Ballard Locks, WA
	Jan. 01-06,09-13 1990	*Ballard Locks, WA
	Jan. 16-20,25-31, 1990	*Ballard Locks, WA
	Jan. 21, 1990	Everett, WA
	Feb. 01,03,05-06, 1990	*Ballard Locks, WA
	Feb. 08-12,16,20, 1990	*Ballard Locks, WA
	Feb. 21,24-27, 1990	*Ballard Locks, WA
	Feb. 22, 1990	Everett, WA
	Mar. 03-08,10-12, 1990	*Ballard Locks, WA
	Mar. 15, 1990	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Mar. 16-17,19-22, 1990	*Ballard Locks, WA
	Mar. 26-30, 1990	*Ballard Locks, WA
	Apr. 01,05-06, 1990	*Ballard Locks, WA
	Apr. 09-10,12, 1990	*Ballard Locks, WA
	Apr. 12, 1990	Everett, WA; Ballard Locks, WA
	Apr. 16-17,26-28, 1990	*Ballard Locks, WA
	Nov. 29, 1990	Ballard Locks, WA
26	Mar. 13, 1989	Captured Shilshole Bay, WA (575 lbs)
	Mar. 14, 1989	Released Klipsan Beach, WA
	Mar. 20, 1989	Race Rocks, B.C.
	Mar. 28, 1989	Everett, WA
	Apr. 10, 1989	Toliva Shoals, WA
	Apr. 12,18,24, 1989	Shilshole Bay, WA
	May 09, 1989	Shilshole Bay, WA
	Jan. 11, 1990	Everett, WA
	Feb. 22,24, 1990	Everett, WA
	Mar. 16, 1989	Everett, WA
	Apr. 09, 1990	Everett, WA
	May 09, 1990	Shilshole Bay, WA
	Feb. 06, 1991	Everett, WA
27	Mar. 22, 1989	Captured Shilshole Bay, WA (570 lbs)
	Mar. 23, 1989	Released Klipsan Beach, WA
	Apr. 13, 1989	Shilshole Bay, WA
	Apr. 19,24,28, 1989	Shilshole Bay, WA
28	Mar. 22, 1989	Captured Shilshole Bay, WA (590 lbs)
	Mar. 23, 1989	Released Klipsan Beach, WA
	Apr. 03, 1989	Shilshole Bay, WA
	Apr. 04, 1989	Shilshole Bay, WA
	Apr. 05, 1989	Ballard Locks, WA
	Apr. 7,17-19,24, 1989	Shilshole Bay, WA
	Apr. 28-29, 1989	Shilshole Bay, WA
	May 09,20, 1989	Shilshole Bay, WA
29	Mar. 24, 1989	Captured Shilshole Bay, WA (580 lbs)
	Mar. 24, 1989	Released Klipsan Beach, WA
	Apr. 03, 1989	Everett, WA
	Apr. 05, 1989	Ballard Locks, WA
	Apr. 13, 1989	Everett, WA
	Apr. 14,17, 1989	Shilshole Bay, WA
	May 02, 1989	Shilshole Bay, WA
	Jan. 20, 1990	Everett, WA
	Feb. 24, 1990	Everett, WA
	Mar. 15, 1990	Everett, WA
	Apr. 12, 1990	Everett, WA
	May 07, 1990	Everett, WA
	Dec. 06, 1990	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jan. 04,22, 1991	Everett, WA
	Jul. 04, 1991	San Miguel Is., CA
	Dec. 29-30, 1991	Everett, WA
30	Mar. 29, 1989	Captured Shilshole Bay, WA (485 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Apr. 12,16-17, 1989	*Ballard Locks, WA
	Apr. 18, 1989	Shilshole Bay, WA
	Apr. 19,22-24, 1989	*Ballard Locks, WA
	Apr. 29, 1989	*Ballard Locks, WA
	May 09-11, 1989	*Ballard Locks, WA
	Jul. 17, 1989	San Miguel Is., CA
	Apr. 5,11-12, 1990	Ballard Locks, WA
	Apr. 14,17-18, 1990	*Ballard Locks, WA
	Apr. 28-29, 1990	*Ballard Locks, WA
	Mar. 27, 1991	Everett, WA
	Apr. 8,16,29,30, 1991	*Ballard Locks, WA
31	Mar. 29, 1989	Captured Shilshole Bay, WA (667 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Apr. 10, 1989	Shilshole Bay, WA
	Apr. 11-14,18, 1989	Shilshole Bay, WA
	Apr. 19, 1989	Recaptured Shilshole Bay,WA (no weight)
	Apr. 19, 1989	Released Klipsan Beach, WA
	Jul. 14, 1989	San Miguel Is., CA
	Mar. 28, 1990	Ballard Locks, WA
	Apr. 19,24, 1990	Shilshole Bay, WA
	Mar. 27, 1991	Everett, WA
32	Mar. 29, 1989	Captured Shilshole Bay, WA (787 lbs)
	Mar. 30, 1989	Released Klipsan Beach, WA
	Apr. 07-08, 1989	Shilshole Bay, WA
	Apr. 11, 1989	Ballard Locks, WA
	Apr. 12,14, 1989	Shilshole Bay, WA
	Apr. 17,19,22, 1989	Shilshole Bay, WA
	Apr. 24, 1989	Shilshole Bay and Burien, WA
	Apr. 26, 1989	West Seattle, WA
	Apr. 28, 1990	Shilshole Bay, WA
	Jan. 14, 1990	*Ballard Locks, WA
	Mar. 15, 1990	Everett, WA
	Apr. 12,16, 1990	Ballard Locks, WA
	Apr. 12, 1991	Shilshole Bay, WA
	Nov. 15, 1993	Ballard Locks, WA
	Jan. 05, 1994	Shilshole Bay, WA
	March 10,15,22, 1994	Shilshole Marina, Dock A
	Apr. 04-05,14,17, 1994	Shilshole Marina, Dock A
	Apr. 19, 1994	Recaptured Shilshole Bay, WA (688 lbs)
	Apr. 27, 1994	Released at Santa Cruz Island, CA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
33	Apr. 06, 1989	Captured Shilshole Bay, WA (545 lbs)
	Apr. 07, 1989	Released Klipsan Beach, Wa
	Apr. 16, 1989	Everett, WA
	Mar. 28, 1994	Everett, WA
34	Apr. 06, 1989	Captured Shilshole Bay, WA (440 lbs)
	Apr. 07, 1989	Released Klipsan Beach, WA
	Apr. 16, 1989	Ballard Locks, WA
	Apr. 17, 1989	Ballard Locks, WA
	Apr. 18, 1989	Everett, WA
	Apr. 19,30, 1989	Ballard Locks, WA
	May 12, 1989	Everett, WA
	Apr. 18, 1995	Shilshole Bay, WA
	Jul. 08-09, 1995	San Nicolas IS., CA
35	Apr. 18, 1989	Captured Shilshole Bay, WA (no weight)
	Apr. 19, 1989	Released Klipsan Beach, WA
	Apr. 09, 1990	Everett, WA
	Apr. 24, 1990	Shilshole Bay, WA
	May 05, 1990	Everett, WA
	Jul. 21, 1990	San Miguel Is., CA
36	Apr. 18, 1989	Captured Shilshole Bay, WA (765 lbs)
	Apr. 19, 1989	Released Klipsan Beach, WA
37	Apr. 18, 1989	Captured Shilshole Bay, WA (672 lbs)
	Apr. 19, 1989	Released Klipsan Beach, WA
	Aug. 08, 1989	Año Nuevo Is., CA
	Feb. 27, 1993	Everett, WA
	May 09, 1994	Shilshole Bay, WA
	Apr. 13, 1995	Shilshole Bay, WA
38	Jan. 15, 1989	*Ballard Locks, WA
	Jan. 22,26, 1989	*Ballard Locks, WA
	Jan. 27, 1989	Dart tag, Shilshole Bay, WA
	Feb. 01,12,25-26, 1989	*Ballard Locks, WA
	Mar. 03,11,14-16, 1989	*Ballard Locks, WA
	Mar. 18-19,21-24, 1989	*Ballard Locks, WA
	Mar. 26-27, 1989	*Ballard Locks, WA
	Mar. 28, 1989	Dart tag, Ballard Locks
	Mar. 28-31, 1989	*Ballard Locks, WA
	Apr. 01-18, 1989	*Ballard Locks, WA
	Apr. 18, 1989	Captured Shilshole Bay, WA (915 lbs)
	Apr. 19, 1989	Released Klipsan Beach, WA
	May 23, 1989	San Miguel Is., CA
	May 24-31, 1989	San Miguel Is., CA
	Jun. 01, 1989	San Miguel Is., CA
39	Apr. 18, 1989	Captured Shilshole Bay, WA (875 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Apr. 19, 1989	Released Klipsan Beach, WA
	Feb. 22, 1990	Everett, WA
	Mar. 15, 1990	Everett, WA
	Dec. 06, 1990	Everett, WA
	Jan. 22, 1991	Everett, WA
	Feb. 06, 1991	Everett, WA
	Mar. 20,27, 1991	Everett, WA
40	(This brand number was used on a harbor seal that was captured in the floating trap at the Locks on 3/24/94. The seal was released in Hood Canal on 3/25/94 and was observed at the Locks 44 days later on 5/7/94)	
41	Feb. 16,22,26 1990	*Ballard Locks, WA
	Mar. 10, 1990	*Ballard Locks, WA
	Mar. 12, 1990	Captured Shilshole Bay, WA (394 lbs)
	Mar. 21, 1990	Released San Miguel Island, CA
	Mar. 22-26, 1990	San Miguel Is., CA
	May 04, 1990	Everett, WA
	May 20, 1990	Everett, WA
	Dec. 26, 1990	Ballard Locks, WA
	Jan. 2,22, 1991	Ballard Locks, WA
	Feb. 4-7,11-15, 1991	*Ballard Locks, WA
	Feb. 22,26-28, 1991	*Ballard Locks, WA
	Mar. 1,4,7,8, 1991	*Ballard Locks, WA
	Mar. 13,14, 1991	Ballard Locks, WA
	Mar. 20,21,25,26, 1991	Ballard Locks, WA
	Mar. 27, 1991	Everett, WA
	Apr. 1-3,5,11, 1991	Ballard Locks, WA
	Apr. 12,15-16,19, 1991	*Ballard Locks, WA
	Apr. 23, 1991	Ballard Locks, WA
	Nov. 16, 1993	Everett, WA
	Dec. ?, 1993	Everett, WA
	Nov. 14, 1994	Everett, WA
	Feb. 04, 1995	*Ballard Locks, WA
	Feb. 05, 1995	Ballard Locks, WA
42	Jan. 03-31, 1990	*Ballard Locks, WA
	Feb. 01-28, 1990	*Ballard Locks, WA
	Mar. 01-11, 1990	*Ballard Locks, WA
	Mar. 12, 1990	Captured Shilshole Bay, WA (915 lbs)
	Mar. 21, 1990	Released San Miguel Island, CA
	Mar. 22-31, 1990	San Miguel Is., CA
	Apr. 01, 1990	San Miguel Is., CA
	Apr. 06, 1990	Grimes Point, CA
	Jun. 02,03, 1990	San Miguel Is., CA
	Dec. 05, 1990	Shilshole Bay, WA
	Dec. 13, 1990	Ballard Locks, WA
	Jan. 04,17,25, 1991	*Ballard Locks, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Feb. 12-14, 1991	*Ballard Locks, WA
	Apr. 02,16,17, 1991	*Ballard Locks, WA
43	Mar. 13, 1990	Captured Shilshole Bay, WA (715 lbs)
	Mar. 21, 1990	Released San Miguel Island, CA
	Mar. 22-24, 1990	San Miguel Is., CA
	May 08, 1990	Columbia River, OR
	May 09-11, 1990	Columbia River (Astoria, OR)
	Dec. 29, 1991	Everett, WA
44	Apr. 11, 1994	Captured Shilshole Bay, WA
	Apr. 12, 1994	Released Klipsan Beach, WA
45	Dec. 20-21,31, 1993	Ballard Locks, WA
	Jan. 03,10,13, 1994	Ballard Locks, WA
	Mar. 12, 1994	Ballard Locks, WA
	Apr. 19, 1994	Captured Shilshole Bay, WA (639 lbs)
	Apr. 27, 1994	Released Santa Cruz Island, CA
	Jun. 04, 1994	San Miguel Is., CA
	Oct. 14, 1994	Shilshole Bay, WA
	Nov. 21, 1994	Recapture, Shilshole Bay, WA (575 lbs)
	Nov. 21, 1994	Release, Shilshole Bay, WA
	Nov. 23, 1994	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 14, 1994	Shilshole Bay, WA
	Jan. 20, 1995	Everett, WA
	Jan. 30, 1995	Ballard Locks, WA
	Mar. 29, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	Apr. 25, 1995	Shilshole Bay, WA
	Apr. 27, 1995	Shilshole Bay, WA
	Apr. 29, 1995	Shilshole Bay, WA
	May 05, 1995	Ballard Locks, WA
	May 17, 1995	Ballard Locks, WA
	May 23, 1995	Ballard Locks, WA
	May 23-24, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Shilshole Bay, WA
	Jun. 05, 1995	Shilshole Bay, WA
	Jun. 10-12, 1995	*Ballard Locks, WA
	Jul. 09, 1995	San Miguel Is., CA
	Oct. 23, 1995	Ballard Locks, WA
	Nov. 02, 1995	*Ballard Locks, WA
	Dec. 08, 1995	*Ballard Locks, WA
46	Apr. 22, 1994	Captured Shilshole Bay, WA (568 lbs)
	Apr. 27, 1994	Released Santa Cruz Island, CA
	Mar. 13, 1995	Bellingham, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
47	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 07, 1994	Everett, WA
	Nov. 14, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Dec. 12, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Dec. 20, 1994	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 20, 1995	Everett, WA
	Aug. 24, 1995	Everett, WA
	Oct. 18, 1995	Shilshole Bay, WA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
48	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 15, 1994	Everett, WA
	Dec. 12, 1994	Everett, WA
	Dec. 19, 1994	Everett, WA
	Jan. 25-26, 1995	Bainbridge Is., WA
	Jan. 29, 1995	Ballard Locks, WA
	Jan. 30- Feb. 02, 1995	Shilshole Bay, WA (sick)
	Feb. 04, 1995	Bainbridge Is., WA
	Mar. 06, 1995	Bainbridge Is., WA (dead)
49	Oct. 28, 1994	Captured Shilshole Bay, WA
	Dec. 07, 1994	Everett, WA
	Dec. 19, 1994	Everett, WA
	Jan. 24, 1995	McNeil Is., WA
	Mar. 24, 1995	Everett, WA
	Aug. 30, 1995	Carroll Is., WA
	Oct. 18, 1995	Everett, WA
	Nov. 08, 1995	McNeil Is., WA
	Nov. 10, 1995	Everett, WA
50	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 14-15, 1994	Everett, WA
	Nov. 23, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 10, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Jun. 18, 1995	San Miguel Is., CA
	Oct. 18, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
51	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 07, 1994	Everett, WA
	Nov. 20, 1994	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Dec. 12, 1994	Everett, WA
	Feb. 23, 1995	Everett, WA
	Aug. 24, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 02, 1995	Recaptured Shilshole Bay, WA (rebrand #260)
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
52	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 03, 1994	Everett, WA
	Nov. 07, 1994	Everett, WA
	Nov. 23, 1994	Everett, WA
	Jun. 20, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
53	Oct. 28, 1994	Captured Shilshole Bay, WA
	Jun. 03, 1995	Shilshole Bay, WA
	Oct. 05, 1995	Everett, WA
54	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 14, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Nov. 23, 1994	Everett, WA
	Jan. 24, 1995	Everett, WA
	Feb. 06, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Jul. 02, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
55	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 08, 1994	Everett, WA
	Nov. 14, 1994	Everett, WA
	Nov. 15, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 12, 1994	Everett, WA
	Dec. 19, 1994	Everett, WA
	Mar. 31, 1995	Everett, WA
	May 03, 1995	Shilshole Bay, WA
	Jun. 05, 1995	San Miguel Is., CA
	Aug. 24, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 16, 1995	Shilshole Bay, WA
56	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 07, 1994	Everett, WA
	Nov. 11, 1994	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Feb. 07, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	May 19, 1995	Recaptured Shilshole Bay, WA (365 lbs)
	Jun. 05, 1995	San Miguel Is., CA
	Sep. 14, 1995	Shilshole Bay Is., CA
	Oct. 18, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
57	Oct. 28, 1994	Captured Shilshole Bay, WA
	Nov. 14, 1994	Everett, WA
	Nov. 15, 1994	Everett, WA
	Nov. 20, 1994	Everett, WA
	Nov. 10, 1995	Everett, WA
58	Nov. 10, 1994	Captured Shilshole Bay, WA (545 lbs)
	Nov. 11, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Dec. 12, 1994	Everett, WA
	Dec. 19, 1994	Everett, WA
	Jan. 24, 1995	Everett, WA
	Jan. 31, 1995	Ballard Locks, WA
	Feb. 14, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
59	Nov. 10, 1994	Captured Shilshole Bay, WA (180 lbs)
60	Nov. 10, 1994	Captured Shilshole Bay, WA (360 lbs)
	Nov. 11, 1994	Everett, WA
	Nov. 14, 1994	Everett, WA
	Nov. 26, 1994	Everett, WA
	Dec. 04, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	May 09, 1995	Everett, WA
	May 10, 1995	Recapture Shilshole Bay, WA
	Jul. 07, 1995	San Miguel Is., CA
61	Nov. 10, 1994	Captured Shilshole Bay, WA (430 lbs)
	Nov. 14, 1994	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Nov. 15, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Nov. 26, 1994	Everett, WA
	Dec. 07, 1995	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Mar. 31, 1995	Shilshole Bay, WA
	Apr. 18, 1995	Everett, WA
	Apr. 21, 1995	Shilshole Bay, WA
62	Nov. 10, 1994	Captured Shilshole Bay, WA (645 lbs)
	Dec. 16, 1994	Shilshole Bay, WA
	Jan. 20, 1995	Everett, WA
	Mar. 16, 1995	West Point Buoy, WA
	Mar. 31, 1995	Shilshole Bay, WA
	Apr. 13, 1995	Everett, WA
	Jun. 22, 1995	San Miguel, Is., CA
	Sep. 13, 1995	Shilshole Bay, WA
	Oct. 18, 1995	Shilshole Bay, WA (am)
	Oct. 18, 1995	Everett, WA (pm)
	Jan. 11, 1995	Recaptured Shilshole Bay, WA
63	Nov. 10, 1994	Captured Shilshole Bay, WA (480 lbs)
	Nov. 14, 1994	Everett, WA
	Nov. 26, 1994	Everett, WA
	Dec. 13, 1994	San Francisco, CA (Pier 39)
	Oct. 18, 1995	Shilshole Bay, WA
	Nov. 07, 1995	Recaptured Shilshole Bay, WA (580 lbs)
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
64	Nov. 10, 1994	Captured Shilshole Bay, WA (345 lbs)
	Nov. 11, 1994	Everett, WA
	Nov. 26, 1994	Everett, WA
	Dec. 04, 1994	Everett, WA
	Dec. 10, 1994	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 20, 1994	Everett, WA
	Feb. 17, 1995	Everett, WA
	Mar. 10, 1995	Everett, WA
	Mar. 24, 1995	Everett, WA
	Mar. 29, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	May 31, 1995	Shilshole Bay, WA
	Nov. 26, 1995	Everett, WA
65	Nov. 10, 1994	Captured Shilshole Bay, WA (420 lbs)
	Nov. 14, 1994	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Nov. 17, 1994	Everett, WA
	Nov. 23, 1994	Everett, WA
	Dec. 04, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Dec. 19, 1994	Everett, WA
	Dec. 20, 1994	Everett, WA
	Apr. 23, 1995	Everett, WA
	Jul. 08, 1995	Anacapa Is. CA
	Oct. 05, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
66	Nov. 10, 1994	Captured Shilshole Bay, WA (395 lbs)
	Nov. 11, 1994	Everett, WA
	Nov. 14, 1994	Everett, WA
	Nov. 15, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 10, 1994	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 15, 1994	Everett, WA
	Feb. 21, 1995	Denman Is., B.C.
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	May , 1995	Shilshole Bay, WA
	May , 1995	Neah Bay, WA
	June 04, 1995	San Miguel Is., CA.
	Sep. 13, 1995	Shilshole Bay, WA
	Oct. 18, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
67	Nov. 10, 1994	Captured Shilshole Bay, WA (295 lbs)
	Nov. 11, 1994	Everett, WA
	Nov. 14, 1994	Everett, WA
	Nov. 17, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 13, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Dec. 20, 1994	Everett, WA
	Mar. 10, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	May 12, 1995	Shilshole Bay, WA
	Oct. 18, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
68	Nov. 21, 1994	Captured Shilshole Bay, WA (617 lbs)
	Nov. 23, 1994	Everett, WA
	Dec. 07, 1994	Everett, WA
	Dec. 09, 1994	Everett, WA
	Dec. 10, 1994	Everett, WA
	Dec. 14, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Jan. 20, 1994	Everett, WA
	Apr. 20, 1994	Everett, WA
	Jul. 20, 1995	San Miguel Is., CA
	Sep. 13, 1995	Shilshole Bay, WA
	Oct. 20, 1995	Everett, WA
69	Dec. 05, 1994	Captured Shilshole Bay, WA (530 lbs)
	Dec. 07, 1994	Everett, WA
	Dec. 10, 1994	Everett, WA
	Dec. 14, 1994	Everett, WA
	Dec. 16, 1994	Everett, WA
	Dec. 20, 1994	Everett, WA
	Feb. 23, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Sep. 12, 1995	Race Rocks, B.C.
	Oct. 10, 1995	Everett, WA
	Oct. 14, 1995	Everett, WA
70	Dec. 05, 1994	Captured Shilshole Bay, WA (450 lbs)
	Dec. 07, 1994	Everett, WA
	Dec. 09, 1995	Shilshole Bay, WA
71	Dec. 22, 1994	Captured Shilshole Bay, WA (205 lbs)
	Feb. 06, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 20, 1995	Everett, WA
	Oct. 05, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
72	Dec. 22, 1994	Captured Shilshole Bay, WA (315 lbs)
	Dec. 26, 1994	Everett, WA
	Mar. 10, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 21, 1995	Recapture Shilshole Bay, WA
	Nov. 26, 1995	Everett, WA
73	Dec. 22, 1994	Captured Shilshole Bay, WA (250 lbs)
	Apr. 11, 1995	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Apr. 18, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	May 07, 1995	Mittlenatch Is., B.C.
	Oct. 20, 1995	Everett, WA
74	Dec. 22, 1994	Captured Shilshole Bay, WA (415 lbs)
	Mar. 23, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 17, 1995	Shilshole Bay, WA
	Apr. 18, 1995	Shilshole Bay, WA
	June 04, 1995	San Miguel Is., CA
	Oct. 18, 1995	Shilshole Bay, WA
	Oct. 20, 1995	Everett, WA
75	Dec. 22, 1994	Captured Shilshole Bay, WA (225 lbs)
76	Dec. 22, 1994	Captured Shilshole Bay, WA (265 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
77	Dec. 22, 1994	Captured Shilshole Bay, WA (365 lbs)
	May 05, 1995	Norris Rocks, B.C.
	July 08, 1995	San Miguel Is., CA
	Oct. 11, 1995	Race Rocks, B.C.
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
78	Dec. 22, 1994	Captured Shilshole Bay, WA (385 lbs)
	Feb. 14, 1995	Everett, WA
	June 20, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
79	Dec. 22, 1994	Captured Shilshole Bay, WA (295 lbs)
	Jan. 20, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 10, 1995	Everett, WA
	Mar. 24 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Jun. 01, 1995	San Miguel Is., CA
	Jul. 04, 1995	San Miguel Is., CA
	Jul. 07, 1995	San Miguel Is., CA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Nov. 26, 1995	Everett, WA
80	Dec. 22, 1994	Captured Shilshole Bay, WA (555 lbs)
	Feb. 14, 1995	Everett, WA
	Mar. 31 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Jun. 18, 1995	San Miguel Is., CA
	Oct. 05, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
81	Dec. 22, 1994	Captured Shilshole Bay, WA (410 lbs)
	Feb. 23, 1995	Everett, WA
	Mar. 10 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	May 04, 1995	Shilshole Bay, WA
	Oct. 05, 1995	Everett, WA
	Nov. 10 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
82	Dec. 29, 1994	Captured Shilshole Bay, WA
	Mar. 10, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Jun. 14, 1995	San Miguel Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
83	Dec. 29, 1994	Captured Shilshole Bay, WA
	Feb. 14, 1995	Everett, WA
	May 25, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	Jul. 20, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
	Nov. 10 1995	Everett, WA
84	Jan. 01, 1995	Captured Shilshole Bay, WA (305 lbs)
85	Jan. 01, 1995	Captured Shilshole Bay, WA (330 lbs)
	Mar. 03, 1995	Race Rocks, B.C.
	Jun. 01-02, 1995	San Miguel Is., CA
	Jun. 06, 1995	San Miguel Is., CA
86	Jan. 01, 1995	Captured Shilshole Bay, WA (485 lbs)
	Mar. 10, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Apr. 21, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	Sep. 12, 1995	Folger Is., B.C.
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
87	Jan. 25, 1995	Captured Shilshole Bay, WA (490 lbs)
	Jan. 25, 1995	Ballard Locks, WA
	Jan. 31, 1995	Ballard Locks, WA
	Feb. 14, 1995	Ballard Locks, WA
	Feb. 23, 1995	Everett, WA
	Mar. 05, 1995	Ballard Locks, WA
	Mar. 25, 1995	Ballard Locks, WA
	Apr. 26, 1995	Ballard Locks, WA
	May 15, 1995	Shilshole Bay, WA
	May 15, 1995	*Ballard Locks, WA
	May 18-19, 1995	Ballard Locks, WA
	May 24, 1995	Ballard Locks, WA
	May 29, 1995	Ballard Locks, WA
	Jun. 06, 1995	Shilshole Bay, WA
	Jun. 08, 1995	Shilshole Bay, WA
	Jun. 12, 1995	Shilshole Bay, WA
	Jun. 12, 1995	Ballard Locks, WA
	Jun. 13, 1995	Recaptured Shilshole Bay, WA (642 lbs)
	Jun. 14, 1995	Released Strait of Juan de Fuca, WA
	Jun. 17, 1995	*Ballard Locks, WA
	Jun. 18, 1995	Shilshole Bay, WA
	Jun. 19, 1995	Ballard Locks, WA
	Jul. 07, 1995	San Miguel Is., CA
	Jul. 09, 1995	San Nicolas Is., CA
	Aug. 23, 1995	Shilshole Bay, WA
	Aug. 28-29, 1995	*Ballard Locks, WA
	Sep. 28, 1995	*Ballard Locks, WA
	Sep. 29, 1995	*Ballard Locks, WA
	Oct. 27, 1995	*Ballard Locks, WA
	Nov. 01, 1995	*Ballard Locks, WA
	Nov. 02, 1995	*Ballard Locks, WA
	Nov. 14, 1995	Everett, WA
	Dec. 20, 1995	Ballard Locks, WA
	Jan. 13,19, 1996	Ballard Locks, WA
88	Jan. 25, 1995	Captured Shilshole Bay, WA (490 lbs)
	Mar. 03, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 21, 1995	Alki Pt., WA
	Apr. 23, 1995	Everett, WA
	May 18, 1995	Shilshole Bay, WA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jul. 03, 1995	San Miguel Is., CA
	Nov. 26, 1995	Everett, WA
89	Jan. 25, 1995	Captured Shilshole Bay, WA (440 lbs)
90	Jan. 25, 1995	Captured Shilshole Bay, WA (575 lbs)
	Apr. 18, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	Apr. 27, 1995	Neah Bay, WA
	Jun. 06, 1995	San Miguel Is., CA
	Oct. 05, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 02, 1995	Shilshole Bay, WA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
91	Jan. 25, 1995	Captured Shilshole Bay, WA (420 lbs)
	Apr. 13, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
92	Jan. 25, 1995	Captured Shilshole Bay, WA (495 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 14, 1995	Everett, WA
	Feb. 23, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	Jun. 01, 1995	Shilshole Bay, WA
	Jun. 07, 1995	Recaptured Shilshole Bay, WA (773 lbs)
	Jun. 17, 1995	Cape Arago, OR
	Jul. 26, 1995	San Miguel Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 16, 1995	Shilshole Bay, WA
93	Jan. 25, 1995	Captured Shilshole Bay, WA (540 lbs)
	Mar. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Sep. 13, 1995	Shilshole Bay, WA
	Sep. 14, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
94	Jan. 25, 1995	Captured Shilshole Bay, WA (380 lbs)
	Jun. 22, 1995	San Miguel, Is., CA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
95	Jan. 25, 1995	Captured Shilshole Bay, WA (380 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Feb. 23, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 10, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 20, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
96	Jan. 25, 1995	Captured Shilshole Bay, WA (475 lbs)
	Mar. 16, 1995	Pill Pt. Barkley Sound, B.C.
	May 09, 1995	Everett, WA
	May 25, 1995	Everett, WA
	Jul. 10, 1995	San Miguel Is., CA
	Nov. 02, 1995	Captured Shilshole Bay, WA (460 lbs)
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
97	Feb. 03, 1995	Captured Shilshole Bay, WA (365 lbs)
	Mar. 10, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Jun. 01, 1995	San Miguel Is., CA
	Jun. 03, 1995	San Miguel Is., CA
	Jun. 05, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
98	Feb. 03, 1995	Captured Shilshole Bay, WA (500 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Feb. 14, 1995	Everett, WA
	Mar. 16, 1995	Fanny Bay, Vancouver Is. B.C.
	Apr. 10, 1995	Shilshole Bay, WA
	Apr. 13, 1995	Everett, WA
	Jun. 04, 1995	Cape Arago, OR
99	Feb. 03, 1995	Captured Shilshole Bay, WA (510 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 29, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 21, 1995	Robinson Pt. Buoy, WA
	May 12, 1995	Shilshole Bay, WA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	May 15, 1995	Shilshole Bay, WA
	May 19, 1995	Shilshole Bay, WA
	May 25, 1995	Shilshole Bay, WA
	Sep. 14, 1995	Shilshole Bay, WA
	Nov. 14, 1995	Everett, WA
	Nov. 21, 1995	Recaptured Shilshole Bay, WA
	Nov. 26, 1995	Everett, WA
100	Feb. 03, 1995	Captured Shilshole Bay, WA (544 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 09, 1995	Race Rocks, B.C.
	Aug. 30, 1995	Carroll Is., WA
	Oct. 18, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
101	Feb. 03, 1995	Captured Shilshole Bay, WA (245 Lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Feb. 14, 1995	Everett, WA
	Mar. 03, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Mar. 24, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	June 27, 1995	San Miguel Is., CA
102	Feb. 03, 1995	Captured Shilshole Bay, WA (745 Lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 07, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Mar. 29, 1995	Everett, WA
	Apr. 19, 1995	Shilshole Bay, WA
	Apr. 25, 1995	Shilshole Bay, WA
	May 15, 1995	Shilshole Bay, WA
	May 18, 1995	Shilshole Bay, WA
	May 23, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	Sep. 12, 1995	Folger, Is., B.C.
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
103	Feb. 03, 1995	Captured Shilshole Bay, WA (345 lbs)

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
104	Feb. 03, 1995	Captured Shilshole Bay, WA (325 lbs)
	Feb. 07, 1995	Everett, WA
	Feb. 14, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Mar. 29, 1995	Everett, WA
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	May 09, 1995	Everett, WA
	June 26, 1995	San Miguel Is
105	Feb. 03, 1995	Captured Shilshole Bay, WA (205 lbs)
	Apr. 25, 1995	Shilshole Bay, WA
	June 04, 1995	Cape Arago, OR
106	Feb. 03, 1995	Captured Shilshole Bay, WA (445 lbs)
	Feb. 06, 1995	Everett, WA
	Feb. 14, 1995	Everett, WA
	Mar. 23, 1995	Everett, WA
	Apr. 03, 1995	Carroll Is., WA
	Nov. 14, 1995	Everett, WA
107	Feb. 03, 1995	Captured Shilshole Bay, WA (355 lbs)
	Feb. 23, 1995	Everett, WA
	Mar. 10, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	May 03, 1995	Shilshole Bay, WA
	May 15, 1995	Shilshole Bay, WA
	May 18, 1995	Shilshole Bay, WA
	May 19, 1995	Shilshole Bay, WA
	July , 1995	San Nicolas Is., CA
108	Feb. 17, 1995	Captured Shilshole Bay, WA (615 lbs)
	Apr. 20, 1995	Bell Chain Is. B.C.
109	Mar. 29, 1995	Captured Shilshole Bay, WA (608 lbs)
	Apr. 23, 1995	Everett, WA
	Aug. 30, 1995	Carroll Is., WA
110	Mar. 29, 1995	Captured Shilshole Bay, WA (530 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	May 19, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	June 22, 1995	San Miguel Is., CA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Aug. 20, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Jan. 15, 1196	Ketron Is., WA (dead)
111	Mar. 29, 1995	Captured Shilshole Bay, WA (595 Lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	July 03, 1995	San Miguel Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
112	Mar. 29, 1995	Captured Shilshole Bay, WA (475 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
113	Mar. 29, 1995	Captured Shilshole Bay, WA (338 Lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	June 22, 1995	San Miguel Is., CA
114	Mar. 29, 1995	Captured Shilshole Bay, WA (420 lbs)
	May 25, 1995	Everett, WA,
	June 24, 1995	San Miguel, Is., CA
	July , 1995	San Nicolas Is., CA
115	Mar. 29, 1995	Captured Shilshole Bay, WA (420 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	July 05, 1995	San Miguel Is., CA
116	Mar. 29, 1995	Captured Shilshole Bay, WA (495 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	June 04, 1995	Gold Beach, OR
	July 25, 1995	Cape Arago, OR
	Aug. 23, 1995	West Point Buoy, WA
117	Mar. 29, 1995	Captured Shilshole Bay, WA (515 lbs)
	Mar. 31, 1995	Everett, WA
	Apr. 03, 1995	Everett, WA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Apr. 21, 1995	Everett, WA
	May 15, 1995	Shilshole Bay, WA
	May 23, 1995	Shilshole Bay, WA
	May 25, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	June 01, 1995	Shilshole Bay, WA
	June 02, 1995	Everett, WA
	July 26, 1995	San Miguel Is. CA
	Nov. 02, 1995	Recapture Shilshole Bay, WA (500 lbs)
	Nov. 14, 1995	Everett, WA
	Nov. 16, 1995	Shilshole Bay, WA
118	Apr. 18, 1995	Captured Shilshole Bay, WA (500 lbs)
	Apr. 13, 1995	Everett, WA
	May 25, 1995	Everett, WA
	June 02, 1995	Everett, WA
	June 22, 1995	Ballard Locks, WA
	June 25, 1995	Ballard Locks, WA
	July 29, 1995	San Miguel Is. CA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
119	Apr. 18, 1995	Captured Shilshole Bay, WA (321 lbs)
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 20, 1995	Everett, WA
	Sep. 12, 1995	Folger Is., B.C.
120	Apr. 10, 1995	Captured Shilshole Bay, WA (402 lbs)
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Shilshole Bay, WA
121	Apr. 10, 1995	Captured Shilshole Bay, WA (530 lbs)
	Apr. 18, 1995	Everett, WA
	May 26, 1995	Shilshole Bay, WA
	June 01, 1995	Shilshole Bay, WA
	June 02, 1995	Everett, WA
122	Apr. 10, 1995	Captured Shilshole Bay, WA (566 lbs)
	Apr. 13, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	Oct. 05, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
123	Apr. 10, 1995	Captured Shilshole Bay, WA (467 lbs)
	Apr. 13, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	June 17, 1995	Cape Arago, OR
	July 09, 1995	San Nicolas Is., CA
	July 21, 1995	Año Nuevo Is., CA
	Oct. 20, 1995	Everett. WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
124	Apr. 10, 1995	Captured Shilshole Bay, WA (349 lbs)
	Apr. 11, 1995	Everett, WA
	Apr. 13, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	May 17, 1995	Recapture Shilshole Bay, WA
	Oct. 05, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
125	Apr. 10, 1995	Captured Shilshole Bay, WA (485 lbs)
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
	Apr. 23, 1995	Everett, WA
	May 03, 1995	Shilshole Bay, WA
	June 08, 1995	San Miguel Is. CA
	Nov. 26, 1995	Everett, WA
126	Apr. 10, 1995	Captured Shilshole Bay, WA (490 lbs)
	Apr. 13, 1995	Everett, WA
	Apr. 18, 1995	Everett, WA
	Apr. 20, 1995	Everett, WA
	Apr. 21, 1995	Everett, WA
127	Apr. 25, 1995	Captured Shilshole Bay, WA (455 lbs)
	Oct. 18, 1995	Shilshole Bay, WA
	Oct. 20, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
128	Apr. 25, 1995	Captured Shilshole Bay, WA (330 lbs)
129	Apr. 25, 1995	Captured Shilshole Bay, WA (238 lbs)
	Jul. 12, 1995	San Miguel Is., CA
130	Apr. 25, 1995	Captured Shilshole Bay, WA (245 lbs)
131	Apr. 25, 1995	Captured Shilshole Bay, WA (390 lbs)
	Apr. 30, 1995	Race Rocks, B.C.
	May 15, 1995	Astoria, OR
	Jun. 20, 1995	San Miguel Is., CA

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BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
132	Apr. 25, 1995	Captured Shilshole Bay, WA (660 lbs)
	Jul. <>, 1995	San Nicolas Is., CA
133	Apr. 25, 1995	Captured Shilshole Bay, WA (260 lbs)
	May 18, 1995	Shilshole Bay, WA
	Jun. 20, 1995	San Miguel Is., CA
134	Apr. 25, 1995	Captured Shilshole Bay, WA (430 lbs)
	Apr. 26, 1995	Shilshole Bay, WA
	Nov. 10, 1995	Everett, WA
135	Apr. 25, 1995	Captured Shilshole Bay, WA (295 lbs)
	Apr. 26, 1995	Shilshole Bay, WA
	Apr. 27, 1995	Shilshole Bay, WA
	Apr. 29, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
	Jun. 17, 1995	San Miguel Is., CA
136	Apr. 25, 1995	Captured Shilshole Bay, WA (300 lbs)
	Apr. 26, 1995	Shilshole Bay, WA
	Jun. 18, 1995	San Miguel Is., CA
137	Apr. 25, 1995	Captured Shilshole Bay, WA (150 lbs)
	Apr. 26, 1995	Shilshole Bay, WA
	Apr. 27, 1995	Shilshole Bay, WA
	May 03, 1995	Shilshole Bay, WA
	Jun. 17, 1995	Cape Arago, OR
	Jun. 20, 1995	San Miguel Is., CA
138	Apr. 25, 1995	Captured Shilshole Bay, WA (155 lbs)
	Apr. 26, 1995	Shilshole Bay, WA
139	Apr. 26, 1995	Captured Shilshole Bay, WA (225 lbs)
	Jun. 04, 1995	Cape Arago, OR
	Jul. 16, 1995	San Miguel Is., CA
140	Apr. 26, 1995	Captured Shilshole Bay, WA (270 lbs)
	Jun. 24, 1995	San Miguel Is., CA
	Oct. 20, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
141	Apr. 26, 1995	Captured Shilshole Bay, WA (260 lbs)
142	Apr. 26, 1995	Captured Shilshole Bay, WA (253 lbs)
	May 04, 1995	Recaptured Shilshole Bay, WA (258 lbs)
	Jul. 30, 1995	Pt. Lobos, CA
143	Apr. 26, 1995	Captured Shilshole Bay, WA (200 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	May 10, 1995	Recaptured Shilshole Bay, WA
144	Apr. 26, 1995	Captured Shilshole Bay, WA (389 lbs)
	Jun. 02, 1995	Everett, WA
	Jul. 13, 1995	San Miguel Is., CA
145	Apr. 26, 1995	Captured Shilshole Bay, WA (443 lbs)
	Jun. 18, 1995	San Miguel, Is., CA
	Nov. 14, 1995	Everett, WA
146	Apr. 26, 1995	Captured Shilshole Bay, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
147	Apr. 26, 1995	Captured Shilshole Bay, WA (300 lbs)
	Apr. 29, 1995	Shilshole Bay, WA
	May. 05, 1995	Shilshole Bay, WA
	May 08, 1995	Shilshole Bay, WA
148	Apr. 26, 1995	Captured Shilshole Bay, WA (260 lbs)
	May, 04, 1995	Recaptured Shilshole Bay, WA
	Jul. 26, 1995	San Miguel Is., WA
149	Apr. 26, 1995	Captured Shilshole Bay, WA (745 lbs)
	Apr. 27, 1995	Shilshole Bay, WA
	May 04, 1995	Shilshole Bay, WA
150	May 04, 1995	Captured Shilshole Bay, WA (402 lbs)
	Jun. 18, 1995	San Miguel Is., CA
151	May 04, 1995	Captured Shilshole Bay, WA (340 lbs)
	May 19, 1995	Shilshole Bay, WA
	Aug. 03, 1995	Spike Rock, WA
	Oct. 05, 1995	Everett, WA
	Nov. 24, 1995	Bainbridge Is., WA (dead)
152	May 04, 1995	Captured Shilshole Bay, WA (320 lbs)
153	May 04, 1995	Captured Shilshole Bay, WA (543 lbs)
	Jun. 04, 1995	Cape Arago, OR
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
154	May 04, 1995	Captured Shilshole Bay, WA (150 lbs)
	May 05, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
155	May 04, 1995	Captured Shilshole Bay, WA (501 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	May 25, 1995	Shilshole Bay, WA
156	May 04, 1995	Captured Shilshole Bay, WA (270 lbs)
	May 05, 1995	Shilshole Bay, WA
	Jun. 10, 1995	San Miguel Is., CA
157	May 04, 1995	Captured Shilshole Bay, WA (265 lbs)
	May 05, 1995	Shilshole Bay, WA
158	May 04, 1995	Captured Shilshole Bay, WA (286 lbs)
159	May 04, 1995	Captured Shilshole Bay, WA (260 lbs)
	May 05, 1995	Shilshole Bay, WA
	May 31, 1995	Cape Arago, OR
	Jun. 04, 1995	Cape Arago, OR
160	May 04, 1995	Captured Shilshole Bay, WA (340 lbs)
	May 05, 1995	Shilshole Bay, WA
	May 10, 1995	Shilshole Bay, WA
	Jun. 08, 1995	San Miguel Is., CA
	Sep. 12, 1995	Folger Is. B.C.
	Nov. 02, 1995	Shilshole Bay, WA
161	May 08, 1995	Captured Shilshole Bay, WA (317 lbs)
	May 28, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
	Jul. <>, 1995	San Nicolas Is., CA
	Oct. 05, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
162	May 08, 1995	Captured Shilshole Bay, WA (258 lbs)
163	May 08, 1995	Captured Shilshole Bay, WA (150 lbs)
164	May 08, 1995	Captured Shilshole Bay, WA (480 lbs)
	Jun. 04, 1995	Cape Arago, OR
	Nov. 03, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
165	May 08, 1995	Captured Shilshole Bay, WA (230 lbs)
166	May 08, 1995	Captured Shilshole Bay, WA (343 lbs)
	Sep. 13, 1995	Race Rocks, B.C.
167	May 08, 1995	Captured Shilshole Bay, WA (475 lbs)
	May 15, 1995	Astoria, OR
	Jun. 04, 1995	San Miguel Is., CA
168	May 08, 1995	Captured Shilshole Bay, WA (320 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
169	May 08, 1995	Captured Shilshole Bay, WA (320 lbs)
	Jun. 30, 1995	San Miguel Is., CA
	Oct. 11, 1995	Race Rocks, B.C.
170	May 08, 1995	Captured Shilshole Bay, WA (780 lbs)
	May 09, 1995	Everett, WA
171	May 08, 1995	Captured Shilshole Bay, WA (410 lbs)
	Jun. 04, 1995	Cape Arago, OR
	Jun. 20, 1995	San Miguel Is., CA
	Nov. 14, 1995	Everett, WA
172	May 10, 1995	Captured Shilshole Bay, WA (250 lbs)
173	May 10, 1995	Captured Shilshole Bay, WA (430 lbs)
	May 26, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
	Jun. 19, 1995	San Miguel Is., CA
	Jun. 25, 1995	San Miguel Is., CA
	Oct. 18, 1995	Shilshole Bay, WA
	Nov. 14, 1995	Everett, WA
174	May 10, 1995	Captured Shilshole Bay, WA (185 lbs)
	Jun. 02, 1995	Everett, WA
175	May 10, 1995	Captured Shilshole Bay, WA (380 lbs)
	May 31-Jun. 04, 1995	Shilshole Bay, WA
	Sep. 12, 1995	Folger Is., B.C.
176	May 10, 1995	Captured Shilshole Bay, WA (335 lbs)
177	May 10, 1995	Captured Shilshole Bay, WA (280 lbs)
178	May 10, 1995	Captured Shilshole Bay, WA (225 lbs)
179	May 10, 1995	Captured Shilshole Bay, WA (185 lbs)
180	May 10, 1995	Captured Shilshole Bay, WA (530 lbs)
	Sep. 13, 1995	Race Rocks, B.C.
	Oct. 18, 1995	Shilshole Bay, WA
	Oct. 20, 1995	Everett, WA
	Nov. 07, 1995	Recaptured Shilshole Bay, WA
	Nov. 10, 1995	Everett, WA
181	May 10, 1995	Captured Shilshole Bay, WA (720 lbs)
	May 19, 1995	Shilshole Bay, WA
	May 24, 1995	Shilshole Bay, WA
	Jun, 20, 1995	San Miguel Is., CA
	Oct. 18, 1995	Cape Arago, OR

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
182	May 10, 1995	Captured Shilshole Bay, WA (235 lbs)
	May 25, 1995	Shilshole Bay, WA
183	May 10, 1995	Captured Shilshole Bay, WA (530 lbs)
184	May 10, 1995	Captured Shilshole Bay, WA (290 lbs)
185	May 15, 1995	Captured Shilshole Bay, WA (385 lbs)
186	May 15, 1995	Captured Shilshole Bay, WA (470 lbs)
	Jun. 20, 1995	San Miguel Is., CA
187	May 15, 1995	Captured Shilshole Bay, WA (280 lbs)
	Jul. 12, 1995	San Miguel Is., CA
188	May 15, 1995	Captured Shilshole Bay, WA (505 lbs)
	May 28, 1995	Shilshole Bay, WA
	May 30, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jun. 01, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Shilshole Bay, WA
	Sep. 13, 1995	Race Rocks, B.C.
	Nov. 03, 1995	Everett, WA
189	May 15, 1995	Captured Shilshole Bay, WA (340 lbs)
	Jun. 26, 1995	San Miguel Is., CA
	Nov. 10, 1995	Everett, WA
190	May 15, 1995	Captured Shilshole Bay, WA (239 lbs)
	May 25, 1995	Shilshole Bay, WA
	Aug. 05, 1995	Año Nuevo Is., CA
191	May 15, 1995	Captured Shilshole Bay, WA (250 lbs)
	May 20, 1995	Shilshole Bay, WA
	May 26, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
192	May 15, 1995	Captured Shilshole Bay, WA (235 lbs)
	May 25, 1995	Shilshole Bay, WA
193	May 15, 1995	Captured Shilshole Bay, WA (205 lbs)
	Jun. 30, 1995	San Miguel Is., CA
194	May 15, 1995	Captured Shilshole Bay, WA (325 lbs)
195	May 15, 1995	Captured Shilshole Bay, WA (200 lbs)
	Jun. 27, 1995	San Miguel Is., CA
196	May 15, 1995	Captured Shilshole Bay, WA (400 lbs)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jun. 23, 1995	San Miguel Is., CA
197	May 15, 1995	Captured Shilshole Bay, WA (405 lbs)
	Jun. 22, 1995	San Miguel Is., CA
198	May 17, 1995	Captured Shilshole Bay, WA (375 lbs)
199	May 17, 1995	Captured Shilshole Bay, WA (400 lbs)
	May 25, 1995	Everett, WA
200	May 17, 1995	Captured Shilshole Bay, WA (525 lbs)
201	May 17, 1995	Captured Shilshole Bay, WA (675 lbs)
	May 18, 1995	Shilshole Bay, WA
	May 25, 1995	Shilshole Bay, WA
	May 26, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jul. 10, 1995	San Miguel Is., WA
	Oct. 05, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
202	May 17, 1995	Captured Shilshole Bay, WA (210 lbs)
203	May 17, 1995	Captured Shilshole Bay, WA (365 lbs)
	May 24, 1995	Recaptured Shilshole Bay, WA (350 lbs)
	May 28, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
204	May 17, 1995	Captured Shilshole Bay, WA (330 lbs)
	May 18, 1995	Shilshole Bay, WA
	Jun. 12, 1995	Waadah Is., WA
	Jul. 24, 1995	San Miguel Is., CA
205	May 17, 1995	Captured Shilshole Bay, WA (500 lbs)
	Jun. 04, 1995	Cape Arago, OR
	Jul. <>, 1995	San Nicolas Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
206	May 17, 1995	Captured Shilshole Bay, WA (560 lbs)
	Jun. 22, 1995	San Miguel Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
207	May 17, 1995	Captured Shilshole Bay, WA (610 lbs)
	May 18, 1995	Shilshole Bay, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
208	May 17, 1995	Captured Shilshole Bay, WA (460 lbs)
	May 18, 1995	Shilshole Bay, WA
	May 19, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	May 30, 1995	Shilshole Bay, WA
209	May 17, 1995	Captured Shilshole Bay, WA (710 lbs)
	May 25, 1995	Shilshole Bay, WA
	Jun. 25, 1995	San Miguel Is., CA
	Oct. 05, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
210	May 17, 1995	Captured Shilshole Bay, WA (590 lbs)
	Oct. 18, 1995	Everett, WA
211	May 17, 1995	Captured Shilshole Bay, WA (265 lbs)
	May 18, 1995	Shilshole Bay, WA
	Jun. 30, 1995	San Miguel Is., CA
	Jul. <>, 1995	San Nicolas Is., CA
212	May 17, 1995	Captured Shilshole Bay, WA (575 lbs)
	May 22, 1995	*Ballard Locks, WA
	Sep. 14, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
213	May 17, 1995	Captured Shilshole Bay, WA (790 lbs)
	Jul. 26, 1995	San Miguel Is., CA
	Oct. 18, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
214	May 17, 1995	Captured Shilshole Bay, WA (660 lbs)
	May 23, 1995	Shilshole Bay, WA
	May 25, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jun. 01, 1995	Shilshole Bay, WA
215	May 19, 1995	Captured Shilshole Bay, WA (296 lbs)
216	May 19, 1995	Captured Shilshole Bay, WA (359 lbs)
	Jul. 08, 1995	San Miguel Is., CA
217	May 19, 1995	Captured Shilshole Bay, WA (525 lbs)
	Oct. 18, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Nov. 14, 1995	Everett, WA
218	May 19, 1995	Captured Shilshole Bay, WA (507 lbs)
	May 25, 1995	Everett, WA
	Jun. 02, 1995	Everett, WA
	Jul. 01, 1995	San Miguel Is., CA
	Nov. 03, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
219	May 19, 1995	Captured Shilshole Bay, WA (435 lbs)
	May 25, 1995	Everett, WA
	Jun. 26, 1995	San Miguel Is., CA
220	May 19, 1995	Captured Shilshole Bay, WA (460 lbs)
	May 23, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jun. 01, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Everett, WA
	Jun. 14, 1995	Astoria, OR
221	May 19, 1995	Captured Shilshole Bay, WA (435 lbs)
	May 23, 1995	Shilshole Bay, WA
	Jun. 10, 1995	San Miguel Is., CA
222	May 19, 1995	Captured Shilshole Bay, WA (248 lbs)
223	May 19, 1995	Captured Shilshole Bay, WA (198 lbs)
	May 20, 1995	Shilshole Bay, WA
	Jun. 04, 1995	Cape Arago, OR
224	May 19, 1995	Captured Shilshole Bay, WA (363 lbs)
	May 20, 1995	Shilshole Bay, WA
	May 23, 1995	Shilshole Bay, WA
225	Feb. 08, 1995	*Ballard Locks, WA
	Feb. 09, 1995	Ballard Locks, WA
	Apr. 21, 1995	Ballard Locks, WA
	May 15, 1995	*Ballard Locks, WA
	May 16, 1995	Ballard Locks, WA
	May 17, 1995	Ballard Locks, WA
	May 22, 1995	Ballard Locks, WA
	May 23, 1995	Captured Shilshole Bay, WA (695 lbs)
	May 23, 1995	Ballard Locks, WA
	May 24, 1995	Recaptured Shilshole Bay, WA
	May 25, 1995	Released Strait of Juan de Fuca, WA
	Jun. 02, 1995	Shilshole Bay, WA
	Jun. 03, 1995	Ballard Locks, WA
	Jun. 07, 1995	Shilshole Bay, WA
	Jul. 08-09, 1995	San Nicolas Is., CA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Oct. 03, 1995	Ballard Locks, WA
	Oct. 05, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
	Jan. 19, 1996	Ballard Locks, WA
226	May 23, 1995	Captured Shilshole Bay, WA (325 lbs)
	Oct. 18, 1995	Everett, WA
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
227	May 23, 1995	Captured Shilshole Bay, WA (320 lbs)
	May 25, 1995	Everett, WA
	May 31, 1995	Shilshole Bay, WA
	Jul. <>, 1995	San Nicolas Is., CA
228	May 23, 1995	Captured Shilshole Bay, WA (255 lbs)
229	May 23, 1995	Captured Shilshole Bay, WA (240 lbs)
	May 25, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
230	May 23, 1995	Captured Shilshole Bay, WA (265 lbs)
231	May 23, 1995	Captured Shilshole Bay, WA (855 lbs)
	May 25, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jun. 01, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Shilshole Bay, WA
	Nov. 14, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
232	May 23, 1995	Captured Shilshole Bay, WA (250 lbs)
	Jun. 17, 1995	Cape Arago, OR
	Jul. 08, 1995	San Miguel Is., CA
233	May 23, 1995	Captured Shilshole Bay, WA (765 lbs)
	May 25, 1995	Shilshole Bay, WA
	May 26, 1995	Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
234	May 23, 1995	Captured Shilshole Bay, WA (185 lbs)
235	May 23, 1995	Captured Shilshole Bay, WA (195 lbs)
	May 25, 1995	Everett, WA
	Jun. 02, 1995	Everett, WA
236	May 23, 1995	Captured Shilshole Bay, WA (620 lbs)
	May 25, 1995	Shilshole Bay, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	May 26, 1995	Recapture Shilshole Bay, WA
	May 28, 1995	Shilshole Bay, WA
	May 30, 1995	Shilshole Bay, WA
	Jun. 22, 1995	San Miguel Is., CA
	Jul. <>, 1995	San Nicolas Is., CA
	Jul. 30, 1995	Año Nuevo Is., CA
237	May 23, 1995	Captured Shilshole Bay, WA (490 lbs)
	May 25, 1995	Everett, WA
	Jun. 02, 1995	Everett, WA
	Oct. 20, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
238	May 23, 1995	Captured Shilshole Bay, WA (370 lbs)
	Nov. 03, 1995	Everett, WA
	Nov. 10, 1995	Everett, WA
239	May 23, 1995	Captured Shilshole Bay, WA (450 lbs)
	May 24, 1995	Recapture Shilshole Bay, WA
	May 26, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Shilshole Bay, WA
240	May 23, 1995	Captured Shilshole Bay, WA (730 lbs)
	May 25, 1995	Everett, WA
	Oct. 18, 1995	Everett, WA
	Nov. 14, 1995	Everett, WA
241	May 23, 1995	Captured Shilshole Bay, WA (405 lbs)
	May 25, 1995	Everett, WA
242	May 24, 1995	Captured Shilshole Bay, WA (473 lbs)
	May 25, 1995	Shilshole Bay, WA
243	May 24, 1995	Captured Shilshole Bay, WA (478 lbs)
	May 25, 1995	Everett, WA
	Jun. 02, 1995	Everett, WA
	Jun. 17, 1995	Cape Arago, OR
244	May 24, 1995	Captured Shilshole Bay, WA (740 lbs)
	May 25, 1995	Shilshole Bay, WA
	May 26, 1995	Shilshole Bay, WA
	Oct. 20, 1995	Everett, WA
	Nov. 26, 1995	Everett, WA
245	May 24, 1995	Captured Shilshole Bay, WA (365 lbs)
246	May 24, 1995	Captured Shilshole Bay, WA (310 lbs)
	May 31, 1995	Shilshole Bay, WA

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

BRAND NUMBER	CAPTURE/RESIGHT DATE	LOCATION
	Jul. 25, 1995	San Miguel Is., CA
247	May 24, 1995	Captured Shilshole Bay, WA (455 lbs)
	May 25, 1995	Shilshole Bay, WA
	Jun. 23, 1995	San Miguel Is. CA
248	May 26, 1995	Captured Shilshole Bay, WA (570 lbs)
	May 28, 1995	Shilshole Bay, WA
	May 31, 1995	Shilshole Bay, WA
	Jul. 17, 1995	San Miguel Is., CA
249	May 26, 1995	Captured Shilshole Bay, WA (252 lbs)
250	May 26, 1995	Captured Shilshole Bay, WA (453 lbs)
	Jun. 01, 1995	Shilshole Bay, WA
	Jun. 19, 1995	Cape Arago, OR
	Jul. 05, 1995	San Miguel Is., CA
	Sep. 01, 1995	Folger Is., B.C.
251	May 26, 1995	Captured Shilshole Bay, WA (705 lbs)
	Jun. 06, 1995	Shilshole Bay, WA
	Jun. 18, 1995	Cape Arago, OR
	Nov. 14, 1995	Everett, WA
252	May 26, 1995	Captured Shilshole Bay, WA (420 lbs)
	Jun. 22, 1995	San Miguel Is., CA
253	May 26, 1995	Captured Shilshole Bay, WA (730 lbs)
	Jun. 30, 1995	San Miguel Is., CA
254	May 26, 1995	Captured Shilshole Bay, WA (550 lbs)
	May 28, 1995	Shilshole Bay, WA
	Jun. 02, 1995	Everett, WA
	Jun. 22, 1995	San Miguel Is., CA
255	Jun. 07, 1995	Captured Shilshole Bay, WA (372 lbs)
	Jul. 09, 1995	San Miguel Is., CA
256	Jun. 13, 1995	Captured Shilshole Bay, WA (600 lbs)
	Jun. 18, 1995	Shilshole Bay, WA
	Jun. 20, 1995	Shilshole Bay, WA
	Sep. 21, 1995	Cape Arago, OR (dead)

*Ballard - indicates that the sea lion was observed preying on salmonids at the Locks.

Appendix B. Marked California sea lions that have been observed in the Shilshole Bay area more than once after marking.

I.D. Number	Number of Times Observed at Shilshole after Marking	Seen at Locks	Last Sighting in Puget Sound
5	4	no	Apr. 1991
6	3	yes	Dec. 1993
7	5	yes	Oct. 1995
8	3	yes	Nov. 1993
9	5	yes	(dead 01/30/94)
10	4	no	May 1989
11	6	yes	May 1989
13	3	no	Dec. 1993
14	13	no	Jun. 1995
15	7	yes	(dead 02/--/90)
16	8	yes	Jun. 1989
17	15	yes	Jan. 1996
18	6	no	May 1989
19	4	yes	Apr. 1990
21	6	no	Jan. 1991
22	4	no	Dec. 1990
23	10	yes	Jan. 1991
24	3	yes	(dead 06/23/89)
25	2	yes	Nov. 1990
26	3	no	Feb. 1991
27	4	no	Apr. 1989
28	10	yes	May 1989
29	3	yes	Dec. 1991
31	4	yes	Mar. 1991
32	19	yes	Apr. 1994
37	2	no	Apr. 1995
45	10	yes	Jan. 1996
55	2	no	Nov. 1995
56	2	no	Nov. 1995
61	2	no	Apr. 1995
62	4	no	Oct. 1995
63	2	no	Nov. 1995
66	2	no	Nov. 1995
74	3	no	Oct. 1995
83	2	no	Nov. 1995
87	7	yes	Nov. 1995
92	3	no	Nov. 1995
99	6	no	Nov. 1995
102	6	no	Nov. 1995
107	4	no	May 1995
110	3	no	Oct. 1995
117	7	no	Nov. 1995
121	2	no	Jun. 1995
135	3	no	Apr. 1995
137	3	no	May 1995
147	3	no	May 1995
149	2	no	May 1995
160	3	no	Nov. 1995
173	2	no	Nov. 1995
180	2	no	Nov. 1995

I.D. Number	Number of Days Observed at Shilshole after marking	Seen at Locks	Last Sighting in Puget Sound
181	2	no	Jun. 1995
188	5	no	Nov. 1995
191	3	no	May 1995
201	4	no	Nov. 1995
203	2	no	May 1995
208	4	no	May 1995
214	5	no	Jun. 1995
220	3	no	Jun. 1995
224	2	no	May 1995
225	3	yes	Nov. 1995
231	4	no	Nov. 1995
233	3	no	May 1995
236	4	no	May 1995
239	4	no	Jun. 1995
244	2	no	Nov. 1995
248	2	no	May 1995
256	2	no	(dead 09/21/95)

APPENDIX C. Summary of sea lion observations in the inner bay from September 26, 1995 through October 4, 1995 with the acoustic devices turned off.

Date	Shift Time On	Shift Time Off	Max. Daily Count	Sea Lion Id#	Hours Spent In Zone 1-4	Zone 5-10	Total Inner Bay		Location of Coho Kills
09/26	12:45	16:36		2	Zc1	-0-	-0-	3.85	Lake@15:34
09/27	10:25	16:32		2	Zc1	-0-	-0-	4.0	Lake@12:00
									Lake@12:17
									Lake@13:28
									Lake@15:40
				Zc2	0.5	0.5	1.0		A1 @11:15
				Zc3	1.0	0.5	1.5		A1 @15:38
09/28	09:00	16:08		4	Zc1	-0-	3.0	3.0	
				Zc2	---	---	1.0		
				Zc3	---	---	1.0		
				Zc4	---	---	3.0		
				#87	3.3	-0-	3.3		A1 @13:15
									A1 @13:27
									A1 @14:19
									A1 @15:10
									A1 @15:22
									A1 @15:35
									A1 @15:44
									A1 @15:53
				Zc5	---	---	0.5		
				Zc6	---	---	2.0		
				Zc7	---	---	0.5		
09/29	09:25	17:40		2	Zc1	2.25	-0-	2.25	A2 @10:13
				#87	5.3	0.5	5.8		A4 @11:36
									A2 @11:43
									A4 @13:26
									A4 @14:31
									A10 @16:32
									A1 @16:42
									A10 @17:12
10/02	11:05	17:10		0					
10/03	10:00	16:37		5	Zc1	0.08	0.08	0.16	(by unid. animals)
				Zc2	---	---	2.0		A6 @14:09
				#225	---	---	1.5		A6 @14:14
				Zc3	---	---	2.5		A10 @14:34
				Zc4	---	---	1.5		A6 @15:06
				Zc5	---	---	1.5		A3 @15:08
				Zc6	---	---	0.5		A6 @15:12
									A8 @15:16
									A8 @15:30
									A1 @16:26
									A1 @16:28
10/04	09:55	16:13		2	Zc1	---	---	0.5	
				Zc2	---	---	0.25		
				Zc3	---	---	2.0		A10 @14:24
									A10 @14:39

Date	Shift Time On	Shift Time Off	Max. Daily Count	Sea Lion Id#	Hours Spent In Zone 1-4	Zone 5-10	Total Inner Bay	Location of Coho Kills
								A10 @14:53 A10 @15:13 A10 @15:49
				Zc4	---	---	0.5	

Total hours observed. 44.35

Cumulative total hours sea lions were present during observations 45.61

Cumulative total hours for unidentified sea lions 35.01

Cumulative total hours for marked sea lions 10.60

Total coho killed in the inner bay by unidentified sea lions (excluding kills in the Lake) 18

Total coho killed in the inner bay by marked sea lions 15

APPENDIX D. Summary of sea lion observations in the inner bay from October 27, 1995 through November 8, 1995 with the acoustic barrier in operation.

Date	Shift Time On	Shift Time Off	Acoustic Barrier On/Off	Max. Daily Count	Sea Lion Id#	Hours Spent In Zone 1-4	Hours Spent In Zone 5-10	Hours Spent In Total	Location of Coho Kills
10/27	08:30	16:30		Off	4	#87	4.45	0.37	4.82 A1 @10:42
									A1 @10:54
									A1 @11:27
									A1 @12:14
									A1 @12:54
									A1 @13:01
									A1 @14:01
						Zc2	2.13	0.12	2.25
						Zc3	3.22	0.10	3.32
						Zc4	0.48	0.00	0.48
						Zc5	0.63	0.03	0.66 A2 @16:04
10/30	09:30	17:00		Off	2	Zc1	0.17	0.58	0.75
						Zc2	0.72	0.03	0.75
10/31	09:00	10:30		Off	0				
10/31	15:00	16:30		Off	2	Zc1	0.22	0.00	0.22
						Zc2	0.22	0.00	0.22
11/01	07:45	17:45		On	2	#87	2.62	0.23	2.85 A6 @14:45
									A3 @15:26
									A2 @16:02
									A2 @16:23
									A1 @17:08
						Zc2	0.03	0.00	0.03
11/02	09:00	17:00		On	2	#87	3.72	0.10	3.82 A4 @09:45
									A2 @11:01
									A1 @11:21
									A1 @11:51
									A1 @12:30
						Zc2	0.23	0.08	0.32
						#45	0.13	0.45	0.58
11/03	08:00	17:15		On	0				
11/06	08:00	09:00		On	0				
11/06	15:30	17:00		On	0				
11/07	08:45	17:15		Off	1	Zc1	0.28	0.22	0.50
						Zc2	0.15	0.07	0.22
						Zc3	0.18	1.58	1.77 A8 @13:48
									A8 @14:05
									A8 @14:10
11/08	08:00	17:15		On	2	Zc1	0.00	0.20	0.20
						Zc2	0.00	0.20	0.20

Total hours observed. 66.0

Date	Shift Time On	Shift Time Off	Max. Daily Count	Sea Lion Id#	Hours Spent In Zone 1-4	Zone 5-10	Total Inner Bay	Location of Coho Kills

Cumulative total hours sea lions were present during observations. 23.96

Cumulative total hours for unidentified sea lions 11.89

Cumulative total hours for marked sea lions 12.07

Total coho killed by unidentified sea lions 4

Total coho killed by marked sea lions 17